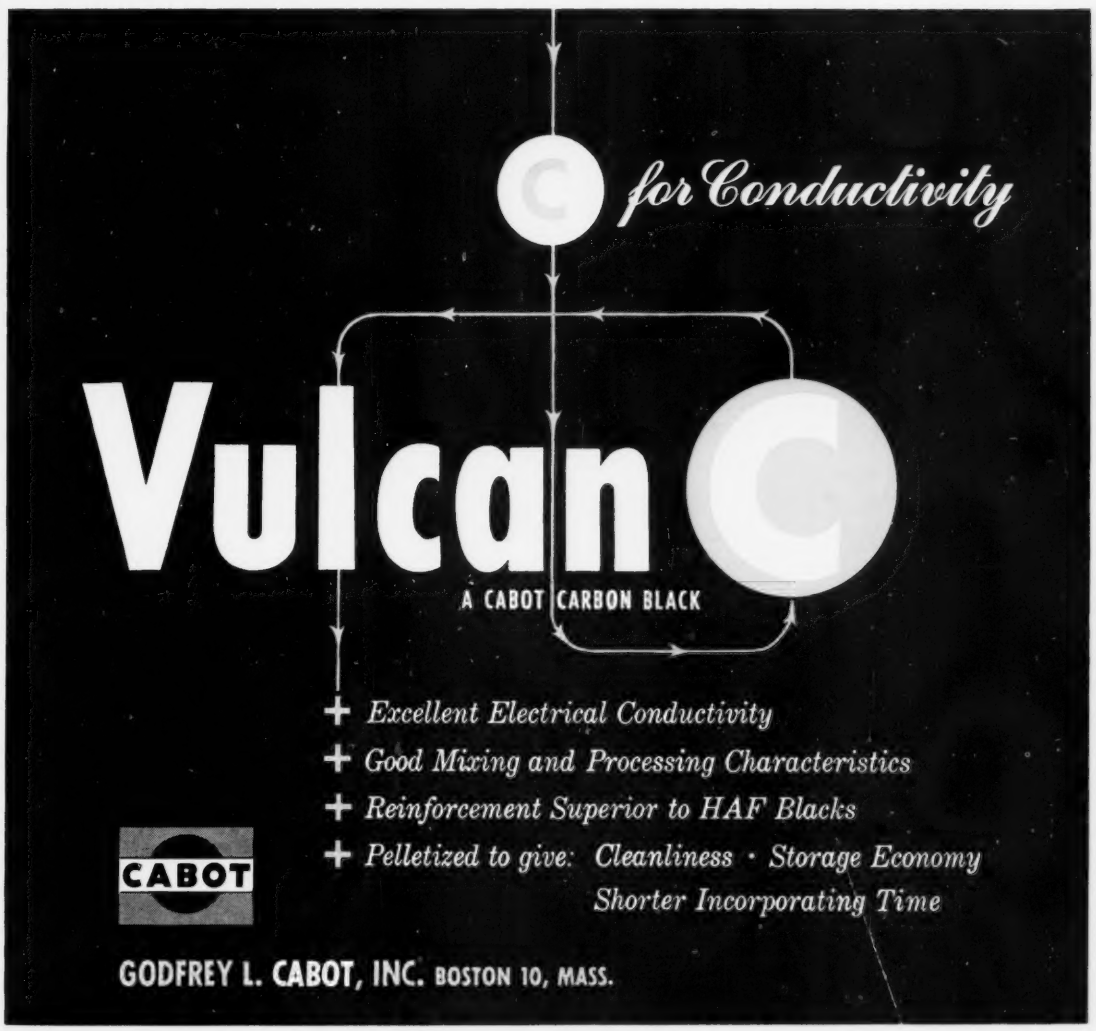
INDIA RUBBER WORLD

OUR

64th YEAR

A BILL BROTHERS PUBLICATION

APRIL, 1953


C for Conductivity
Vulcan C
A CABOT CARBON BLACK
+ Excellent Electrical Conductivity
+ Good Mixing and Processing Characteristics
+ Reinforcement Superior to HAF Blacks
+ Pelletized to give: Cleanliness · Storage Economy
Shorter Incorporating Time
CABOT
GODFREY L. CABOT, INC. BOSTON 10, MASS.

NEW!

Du Pont SELECT Rubber Dispersed Colors . . . are

prepared by a special process, developed by Du Pont, which assures maximum tinctorial strength, uniformity, and dispersibility.

Because the pigment is dispersed in an elastomeric base, there is no fly loss . . . no dusting to annoy personnel or to contaminate your milling equipment and your plant. Du Pont Select Rubber Colors are very easy to handle and can be weighed quickly and accurately.

The following colors are available:

Rubber Red PBD
Rubber Red 2BD
Rubber Orange OD
Rubber Yellow GD
Rubber Green FD
Rubber Green GSD
Rubber Blue GD
Rubber Blue PCD

. . . a new color for new brightness in your rubber products

Du Pont Rubber Orange OD is offered to the rubber industry as a new color having improved brightness and uniformity. In addition, Rubber Orange OD shows very good light fastness and excellent retention of color during press, open steam, and CV cures and in hard rubber compounds. It exhibits no migration, crocking, or bleeding (when exposed to boiling water and 10% soap solution).

Write or phone our nearest district office for further information.

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DU PONT RUBBER CHEMICALS

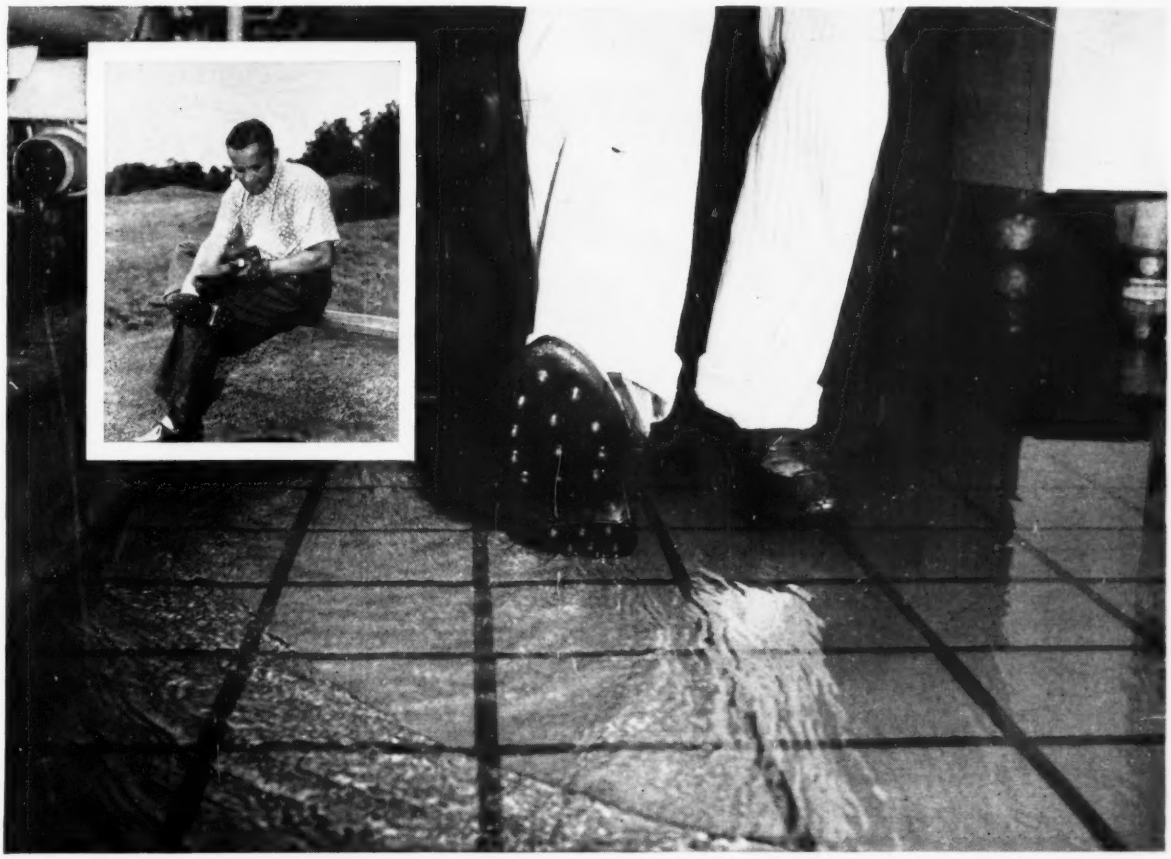
DU PONT

BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*

India Rubber World, April, 1953, Vol. 128, No. 1. Published monthly by Bill Brothers Publishing Corp. Office of Publication, 1309 Noble Street, Philadelphia, Pa., with Editorial and Executive Offices at 386 Fourth Avenue, New York 16, N. Y., U.S.A. Entered as Second Class Matter at the Post Office at Philadelphia, Pa., under the act of March 3, 1879. Subscription United States and Mexico, $5.00 per year; Canada $6.00; All other Countries $7.00; Single Copies 50 cents. Address Mail to N. Y. Office.

News about

B. F. Goodrich Chemical *raw materials*



These non-skid rubbers made by Tingley Rubber Corp., Rahway, N. J. B. F. Goodrich Chemical Co. supplies the Good-rite Resin 50 only.

NON-SKID RUBBERS GIVE WEARERS A BRAKE!

Good-rite Resin 50 improves abrasion resistance and wear

ONE look at these rubbers and you can see an important advantage—built-in rubber cleats that give safer traction on wet surfaces, ice or snow or other risky footing.

And there's another great advantage: the use of Good-rite Resin 50 in the rubber sole compound, to provide longer wear and improved surface abrasion resistance.

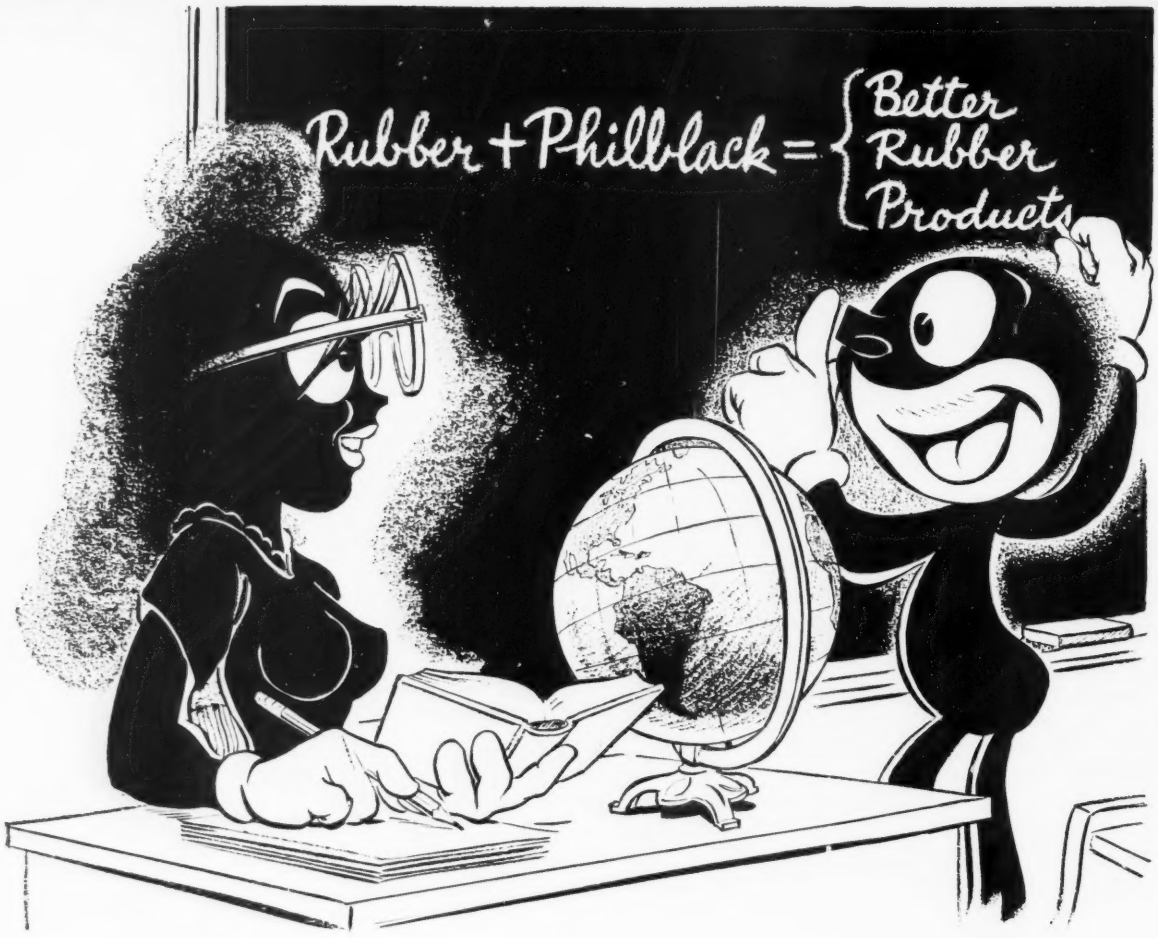
Soling compounds are just one of many products that are helped by Good-rite Resin 50. For this easy-processing, reinforcing and stiffening agent is compatible with crude rubber and most American rubbers. It affords a new and simple approach to hardness problems. It saves time by eliminating masterbatching. It gives rubber compounds better flex life, higher elongation, improved abrasion resistance and better handling because Resin 50 acts as a plasticizer at processing temperatures.

A white, free-flowing powder, Good-rite Resin 50 can be compounded in a wide range of colors. For helpful technical information, please write Dept. HA-4, B. F. Goodrich Chemical Company, Rose Building, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

B. F. Goodrich Chemical Company
A Division of The B. F. Goodrich Company

Hycar
Reg. U.S. Pat. Off.
American Rubber

GEON polyvinyl materials • HYCAR American rubber • GOOD-RITE chemicals and plasticizers • HARMON colors



Whatever your rubber problem may be There's a **Philblack*** *to solve it...* **A, O,** *or* **E!**

The Philblacks come up with the right answers to a lot of difficult questions!

Philblack A can show you how to turn out smooth tubings at high speeds. Easy mixing, too. And this MAF black gives good physical characteristics to finished products.

Philblack O knows how to reduce dangerous static electricity in tires, belts and hoses. This HAF black provides excellent abrasion resistance, good flex life, fine stress-strain qualities.

Philblack E is the right answer when it comes to adding mileage to tire treads. This SAF black provides outstanding abrasion resistance and excellent resistance to cut and crack growth.

For full information, consult our technical sales representative or write our nearest office.

PHILLIPS CHEMICAL COMPANY

PHILBLACK SALES DIVISION

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* A Trademark

Philblack E, Philblack O, and Philblack A are manufactured at Borger, Texas. Warehouses in Akron, Boston, Chicago and Trenton. West Coast agent: Harwick Standard Chemical Company, Los Angeles. Canadian agent: H. L. Blachford, Ltd., Montreal and Toronto.

Here's ozone protection—all year 'round!

....with *Sunproof*®

This unusually efficient static-cracking inhibitor wards off the effects of light and ozone in any season—gives *constant* protection against frosting, checking, and atmospheric cracking.

Carefully blended of special waxes, Sunproof can be used in natural rubber, and in GR-S, GR-A, and other Buna N stocks. It mixes readily, requires no handling precautions, and is harmless to the skin. Sunproof is non-discoloring, too, and does not affect rate of cure or aging properties.

Available in three strengths, Sunproof 713, Improved, or Junior, this anti-cracking agent has proved its effectiveness in farm tires and whitewalls, sponge gaskets, windshield stripping, wire insulation, mechanicals, footwear, clothing, drug sundries, and many more applications.

Make sure *your* products enjoy the protection of this proven rubber chemical. For more information on Sunproof, write to the address below.

Naugatuck Chemical

Division of United States Rubber Company
134 Elm Street, Naugatuck, Conn.
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Rubber Chemicals • Aromatics • Synthetic Rubber • Plastics • Agricultural Chemicals
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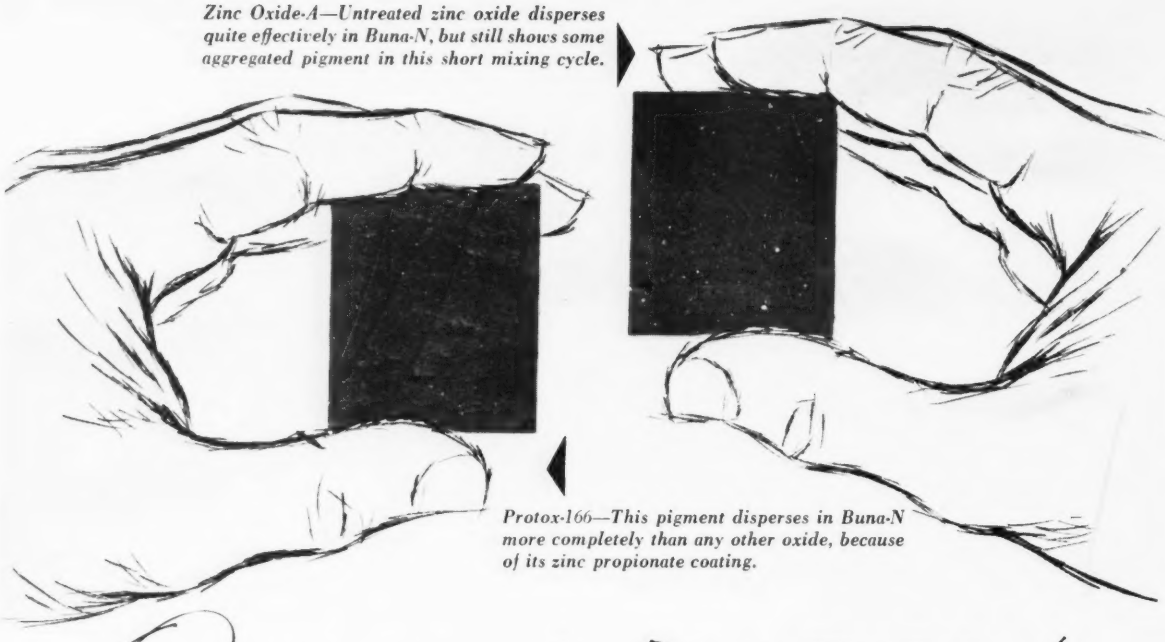

Zinc Oxide-A—Untreated zinc oxide disperses quite effectively in Buna-N, but still shows some aggregated pigment in this short mixing cycle.

Protox-166—This pigment disperses in Buna-N more completely than any other oxide, because of its zinc propionate coating.

Outstanding for DISPERSION

...PROTOX* ZINC OXIDES

Protox oxides speed your processing and upgrade your compounds . . . because they disperse faster and more completely than conventional oxides, even under adverse conditions.

IN ANY WEATHER

One of our first customers for Protox was a rubber manufacturer who was troubled by poor zinc oxide dispersion on hot, humid days. Protox-166 eliminated that difficulty.

IN ANY RUBBER

Protox oxides definitely plasticize Buna-N and other hard-to-process elastomers, thus providing softer, easier-working stocks.

This plasticizing effect does not hinder the dispersion of Protox oxides, because their unique coating of zinc propionate serves both as plasticizer and dispersing agent.

Where can Protox oxides cut your costs and improve your compounds?

We shall be glad to discuss that question with you.

*U. S. Patents 2,303,329 and 2,303,330

THE NEW JERSEY ZINC COMPANY

Producers of Horse Head Zinc Pigments

. . . most used by rubber manufacturers since 1852

160 Front Street, New York 38, N. Y.

HORSE HEAD PRODUCTS

IN SUBMARINES . . .

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IN THE RUBBER INDUSTRY . . .

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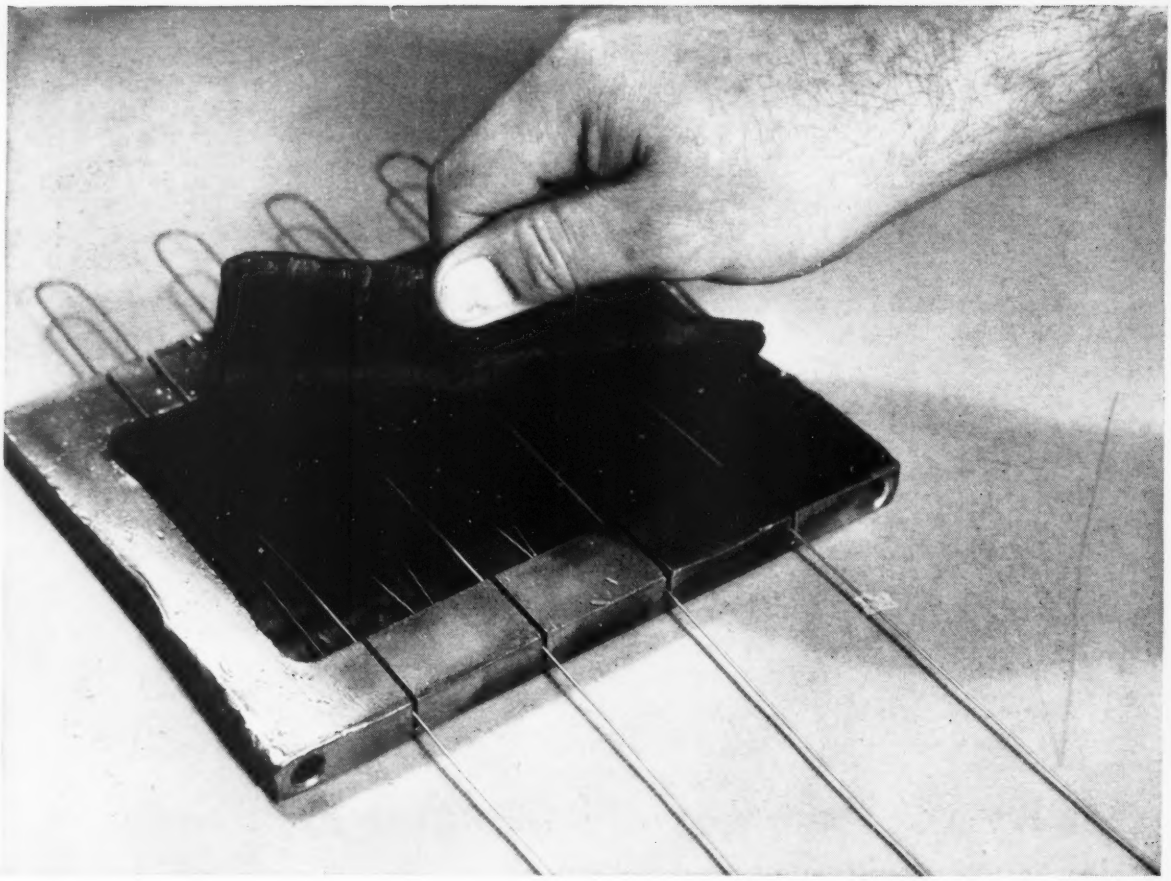

How we use pull...

to help your wire do a better job!

• It doesn't pay to take things for granted. That's why extensive wire research goes on *all* the time at National-Standard — behind-the-scenes work that time and again helps our customers speed operations, save material, improve their products and cut costs.

The lab test being rigged above, for example, will reveal the rubber adhesion qualities of a newly developed wire finish. After the rubber layers are vulcanized, carefully recorded pull will be exerted on the imbedded wire until it finally breaks loose. Only by such painstaking test work can you be assured of new, improved qualities and characteristics that will let you make the *most* of wire.

Whatever use you make of wire—in rubber products, or anything from bottle caps to zither strings —keep in mind that National-Standard's facilities, experience and "groundwork" are always ready to help you put wire to work with the *greatest* efficiency at the *lowest* cost.

NS NATIONAL-STANDARD Company NILES, MICHIGAN

DIVISIONS OF NATIONAL-STANDARD CO.

ATHENIA STEEL.. *Clifton, N. J.*	Flat, High Carbon, Cold Rolled Spring Steel
NATIONAL-STANDARD.. *Niles, Mich.*	Tire Wire, Stainless, Fabricated Braids and Tape
REYNOLDS WIRE.. *Dixon, Illinois*	Industrial Wire Cloth
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CABOT

Declared NONtoxic by F.D.A.*

DI-ISO-BUTYL ADIPATE

Cabflex Di-BA

*Nontoxic means "suitable" for use in food packaging materials.

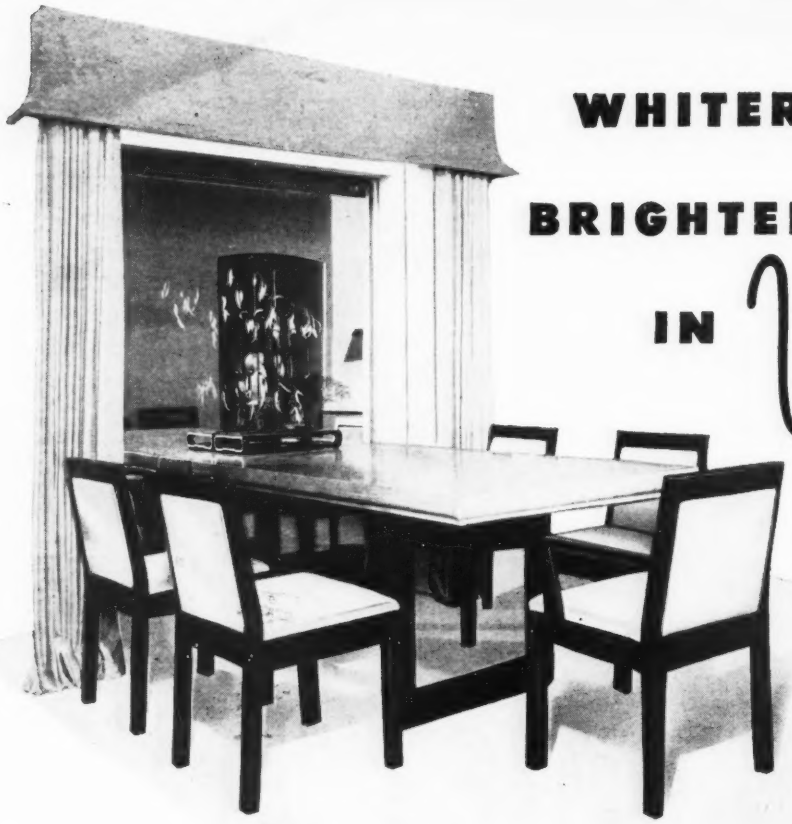
"Suitability means that under the conditions of use, and in the amounts now employed to produce a finished film, di-iso-butyl adipate has such a low order of solubility as to be insignificant as a food contaminant when weighed in the light of the toxicological evidence." ". . . this plasticizer has had adequate pharmacological study demonstrating its harmlessness in the amounts now used in finished commercial films . . ."

Reprinted from Association of Food & Drug Officials of the United States Vol. XV, No. 3, July 1951

Cabflex Di-BA *di-iso-butyl adipate*
Cabflex Di-OP *di-iso-octyl phthalate*
Cabflex DCP *di-capryl phthalate*
Cabflex DDP *di-decyl phthalate*
Cabflex Di-OA *di-iso-octyl adipate*
Cabflex DDA *di-decyl adipate*

Cabot produces the nontoxic plasticizer Cabflex Di-BA and does not make the finished film.

Plasticizer Division
GODFREY L. CABOT, INC.
77 FRANKLIN STREET, BOSTON 10, MASS.



WHITER, BRIGHTER BEAUTY IN *Vinyl*

White upholstery, even white floor coverings, once symbols of fabulous luxury, become work-a-day beauties in vinyl. Washable and long-lasting, vinyl materials are finding wide use in the decorating field today.

Maximum whitening, brightening and opacifying effects per pound of pigment used are achieved with TITANOX-RA (rutile titanium dioxide). In addition, the uniformity of whiteness and light tints, so important to these products, is assured through your choice of TITANOX-RA as the white pigment.

Consult our Technical Service Department for friendly cooperation on problems in the white pigmentation of natural and synthetic polymers. Titanium Pigment Corporation, 111 Broadway, New York 6, N. Y.; Atlanta; Boston 6; Chicago 3; Cleveland 15; Los Angeles 22; Philadelphia 3; Pittsburgh 12; Portland 9, Ore.; San Francisco 7. In Canada: Canadian Titanium Pigments Limited, Montreal 2; Toronto 1.

1682

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the brightest name in pigments

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TITANIUM PIGMENT CORPORATION

Subsidiary of NATIONAL LEAD COMPANY

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on *NEW*
RECLAIMATOR
(Dip-Process)
RECLAIMS

. . for tire treads, sidewalls, camelback, mechanical rubber goods and battery boxes.

By developing a revolutionary rubber reclaiming process, using the patented RECLAIMATOR, U. S. is now able to produce a superior type of reclaim at prices comparable to ordinary reclaims.

These new Dip-Process Reclaims are offering rubber manufacturers GREATER VALUE in THREE WAYS. First, higher abrasion resistance, better resilience and lower heat build-up give your product HIGHER QUALITY. Second, because these reclaims are easier to handle and process, YOU SAVE MONEY on manufacturing costs. Third, your material COSTS are LOWER, because less of these new Dip-Process Reclaims are required to do the same job.

With NO OBLIGATION on your part we invite you to write us for free test samples. You owe it to yourself and your company to get the facts on this newest development in the reclaimed rubber industry. Specify R-525 for tires, treads and sidewalls; R-500 for Camelback; R-805 for mechanical rubber products; R-300 for hard rubber battery boxes and R-400-NB for white sidewall tires and other non-staining applications.

Always keep reclaims in your formula and always look to U. S. for the best. U. S. Rubber Reclaiming Company, Inc., P. O. Box 365, Buffalo 5, N. Y. Trenton Agent: H. M. Royal, Inc., 689 Pennington Ave., Trenton, N. J.

U.S. *70 years serving the industry solely as reclaimers*

RUBBER RECLAIMING COMPANY, INC.

Close the sale with this **UNSEEN SALES POINT**

—a clean neutral odor

More and more manufacturers are increasing their sales of foam- and sponge-rubber products, and other rubber goods, by making certain that they combine the advantages of rubber with a clean, *neutral* odor. They are treating their rubber products with Du Pont "Alamask" odor-masking compounds.

You, too, can capitalize on this "unseen sales point" —and at almost negligible cost. Only a small quantity of "Alamask" is required in each batch, and no special equipment is necessary to apply it.

"Alamask" compounds are durable to processing. They will not break down in aeration, banburying, or curing systems, or at high temperatures. The effect of the "Alamask" will last until the unpleasant odors, caused by blowing agents and processing materials have disappeared in use. "Alamask" will make your pillows, cushions, upholstery, rug pads and rubber tile easier to sell.

One of the "Alamask" odor-masking compounds is designed to suit your needs. For more information— or for technical service on any "Alamask" application —write E. I. du Pont de Nemours & Co. (Inc.), Organic Chemicals Department, Aromatics Section, Wilmington 98, Delaware.

Du Pont **Alamask** Odor-Masking Compounds

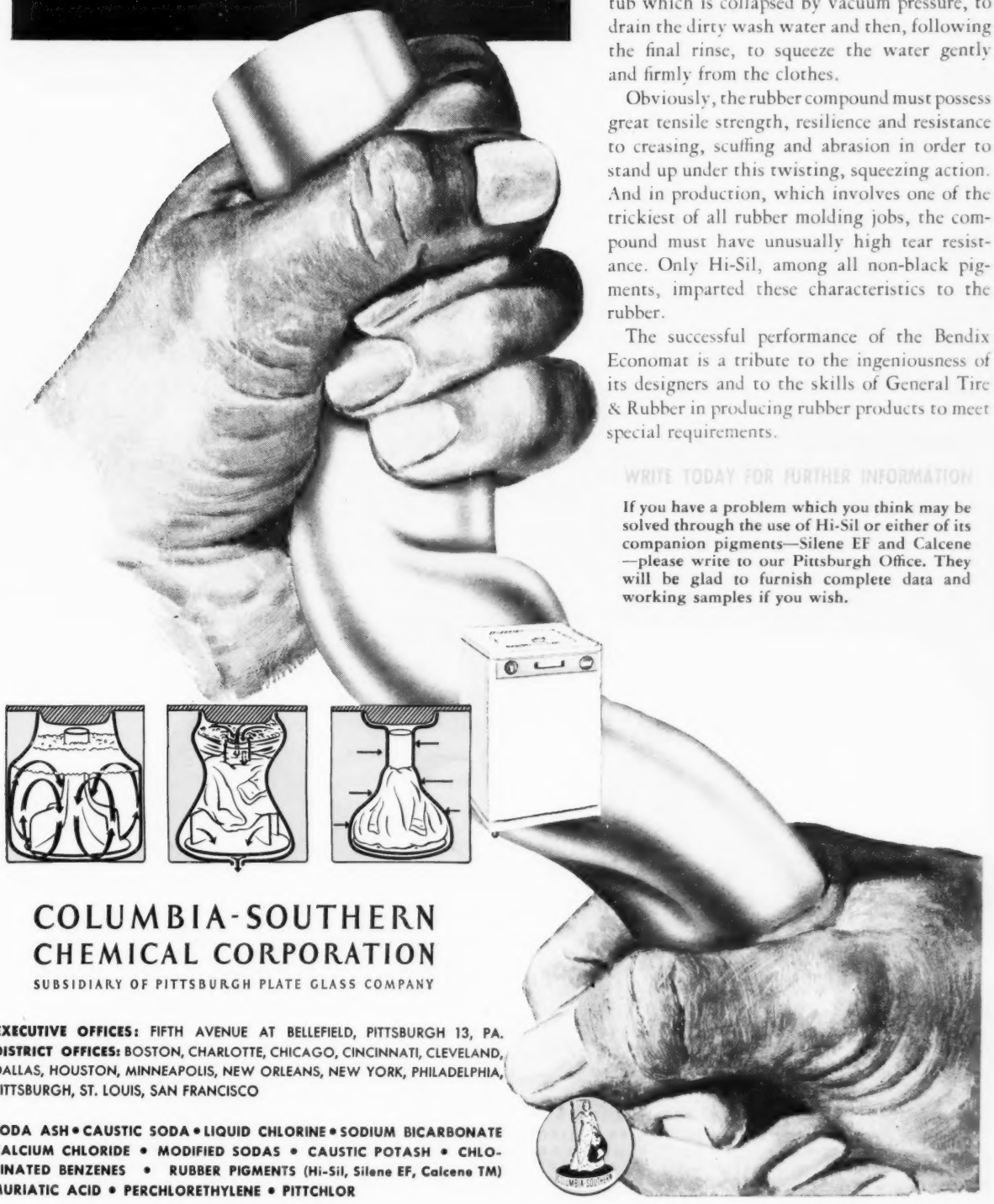
TRADEMARK

DU PONT

REG. U.S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING
. . . *THROUGH CHEMISTRY*

A tricky twist IN RUBBER SHOWS THE VALUE OF COLUMBIA-SOUTHERN'S hi-sil®



Faced with the problem of developing a light-grey rubber compound to meet an extremely exacting usage, the General Tire & Rubber Company found that only one non-black reinforcing pigment would meet requirements.

General's problem was presented by Bendix Home Appliances, in connection with the revolutionary design of its Economat automatic washer. The heart of this washer is the "Metexaloy Wondertub"—a flexible rubber tub which is collapsed by vacuum pressure, to drain the dirty wash water and then, following the final rinse, to squeeze the water gently and firmly from the clothes.

Obviously, the rubber compound must possess great tensile strength, resilience and resistance to creasing, scuffing and abrasion in order to stand up under this twisting, squeezing action. And in production, which involves one of the trickiest of all rubber molding jobs, the compound must have unusually high tear resistance. Only Hi-Sil, among all non-black pigments, imparted these characteristics to the rubber.

The successful performance of the Bendix Economat is a tribute to the ingeniousness of its designers and to the skills of General Tire & Rubber in producing rubber products to meet special requirements.

WRITE TODAY FOR FURTHER INFORMATION

If you have a problem which you think may be solved through the use of Hi-Sil or either of its companion pigments—Silene EF and Calcene—please write to our Pittsburgh Office. They will be glad to furnish complete data and working samples if you wish.

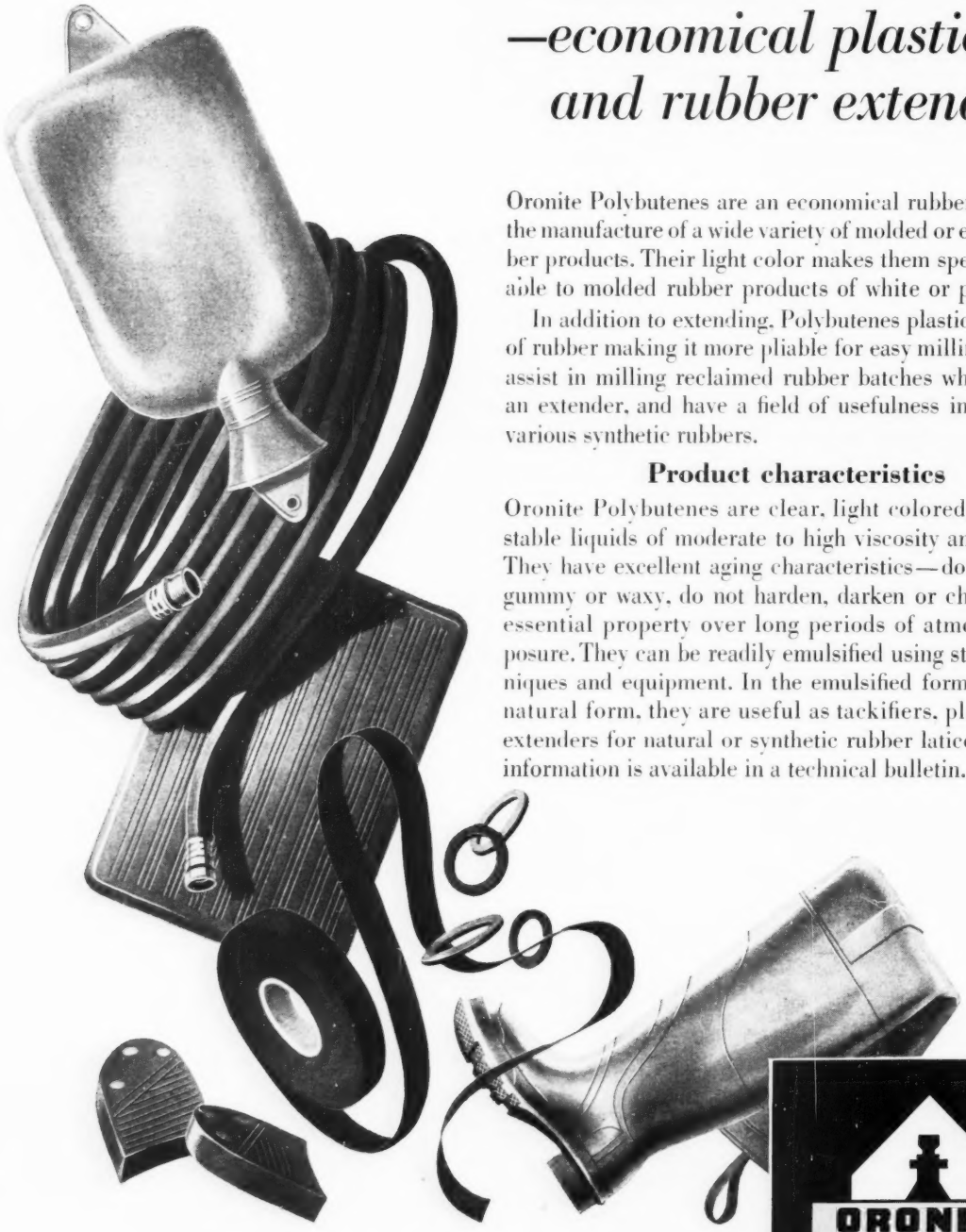
COLUMBIA-SOUTHERN CHEMICAL CORPORATION

SUBSIDIARY OF PITTSBURGH PLATE GLASS COMPANY

EXECUTIVE OFFICES: FIFTH AVENUE AT BELLEFIELD, PITTSBURGH 13, PA.
DISTRICT OFFICES: BOSTON, CHARLOTTE, CHICAGO, CINCINNATI, CLEVELAND, DALLAS, HOUSTON, MINNEAPOLIS, NEW ORLEANS, NEW YORK, PHILADELPHIA, PITTSBURGH, ST. LOUIS, SAN FRANCISCO

SODA ASH • CAUSTIC SODA • LIQUID CHLORINE • SODIUM BICARBONATE CALCIUM CHLORIDE • MODIFIED SODAS • CAUSTIC POTASH • CHLORINATED BENZENES • RUBBER PIGMENTS (Hi-Sil, Silene EF, Calcene TM) MURIATIC ACID • PERCHLORETHYLENE • PITTCHLOR

Inquire about Oronite
POLYBUTENES
—economical plasticizers and rubber extenders



Oronite Polybutenes are an economical rubber extender in the manufacture of a wide variety of molded or extruded rubber products. Their light color makes them specially adaptable to molded rubber products of white or pastel colors.

In addition to extending, Polybutenes plasticize the mass of rubber making it more pliable for easy milling. They also assist in milling reclaimed rubber batches while acting as an extender, and have a field of usefulness in plasticizing various synthetic rubbers.

Product characteristics

Oronite Polybutenes are clear, light colored, chemically stable liquids of moderate to high viscosity and tackiness. They have excellent aging characteristics—do not become gummy or waxy, do not harden, darken or change in any essential property over long periods of atmospheric exposure. They can be readily emulsified using standard techniques and equipment. In the emulsified form, or in their natural form, they are useful as tackifiers, plasticizers or extenders for natural or synthetic rubber latices. Complete information is available in a technical bulletin.

Write or phone the Oronite office nearest you and talk over your problem with us.

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The finest name in Rutile Titanium Dioxide

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...gives you a whiter white...and it's easier to grind

Glidden research has achieved greater whiteness and a highly accelerated dispersion rate in new Glidden ZOPAQUE-R. These new developments combine to produce pigments with exceptional hiding power, outstanding gloss and color retention and low reactivity.

Write today for more details on new Glidden ZOPAQUE-R, the finest name in Rutile Titanium Dioxide.

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ZOPAQUE-R66—All-purpose Rutile
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QUALITY Glidden PRODUCTS

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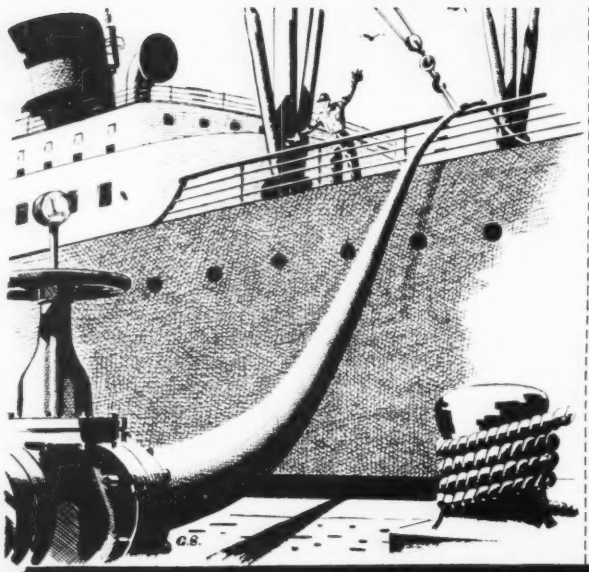

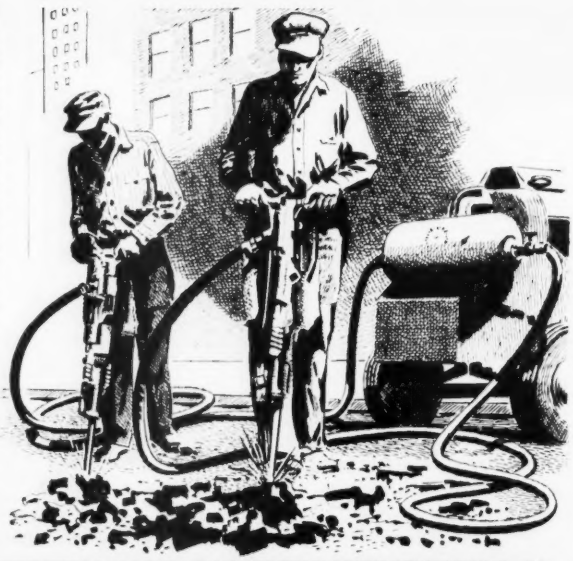

If it's got to lead a FLEXIBLE LIFE...

make it "SHAWMUT HOSE DUCK"

another Wellington Sears fabric for the rubber industry

A flexible life . . . and a long and satisfactory one! That's the basic result story of Shawmut Hose Duck, proven in a wide variety of rubber-and-fabric applications.

Especially suited for rubberized hoses for liquids and compressed air, this duck is a soft, open, plied-yarn cotton fabric affording flexibility and good impregnation. It is available in many standard, as well as non-standard, constructions to meet specific requirements.

Shawmut Hose Duck is but one of the many famous Wellington Sears cotton ducks for hoses, belting and other mechanical rubber products. Available from this "headquarters for industrial fabrics," for example, are Dredge Sleeve Duck for large suction hoses and Superior Army Duck widely used as a cover fabric for V-belts.

Based on its 100-year experience in heavy duty fabrics, Wellington Sears also offers fabrics incorporating the unique properties of nylon, high tenacity rayon and other fibers for steam hoses, bulk loading of chemicals and grains and other uses.

Whatever your rubber-and-fabric problem—see Wellington Sears first.

An illustrated 24-page booklet filled with valuable facts on fabric development and applications of interest to present and potential users of industrial fabrics is yours for the asking. Write for a free copy of "Modern Textiles for Industry" to Wellington Sears Co., Dept. K-2, 65 Worth Street, New York 13.

Superior Fabrics for the Rubber Industry

- Belting duck
- Hose duck
- Enameling duck
- Army duck
- Single and plied-yarn chafers
- Sheeting
- Airplane cloth
- Balloon cloth
- Nylon, high-tenacity rayon, other synthetics and combinations.

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A SUBSIDIARY OF WEST POINT MANUFACTURING COMPANY

FIRST In Fabrics For Industry

WELLINGTON SEARS COMPANY, 65 WORTH STREET, NEW YORK 13, N. Y.

OFFICES IN: ATLANTA · BOSTON · CHICAGO · DETROIT · LOS ANGELES · NEW ORLEANS · PHILADELPHIA · SAN FRANCISCO · ST. LOUIS

PLIOVIC—ready to break production records in Eastern plant.

FILM MANUFACTURER REPORTS:

NEW HIGHS IN PRODUCTION *with* ***PLIOVIC***

"New production record this week, last week, and the week before"—so goes the report on a large, Eastern vinyl film manufacturer. And the reason for this successively increasing production is PLIOVIC—Goodyear's polyvinyl chloride resin.

With no change in equipment and only slight modifications in compounding, this cost-conscious maker of quality film put PLIOVIC in his plant. He made a trial run and he liked what he saw. He liked the high bulk density – the easier handling. He liked the faster premixing. He liked the higher calender speeds. He liked the exceptional resistance to heat and light—the safe reworking of trim and tailings. And he liked the excellent physical properties of the finished film. Today, he and Goodyear both like the extra PLIOVIC going into his plant and the extra film coming out.

Put PLIOVIC in your plant. You'll find it to your liking, too. For full information and samples, just contact your Chemical Division representative or write to:

Goodyear, Chemical Division, Akron 16, Ohio

Chemigum, Pliobond, Pliolite, Pliovic—T. M.'s The Goodyear Tire & Rubber Company, Akron, Ohio

Use-Proved Products — CHEMIGUM • PLIOBOND • PLIOLITE • PLIOVIC • WING-CHEMICALS —The Finest Chemicals for Industry

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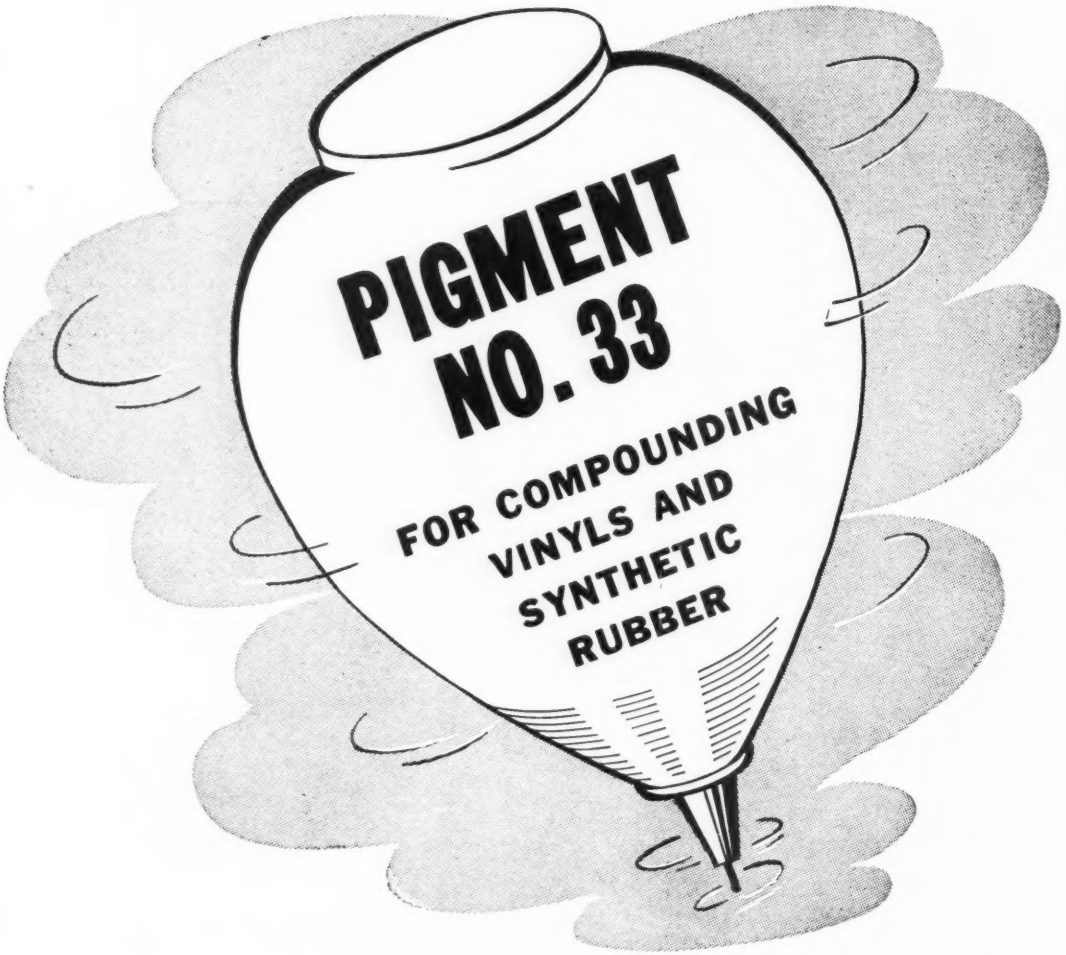
IT'S "TOPS"



- SUPERIOR ELECTRICAL TESTS
- HEAT STABILITY
- COLOR

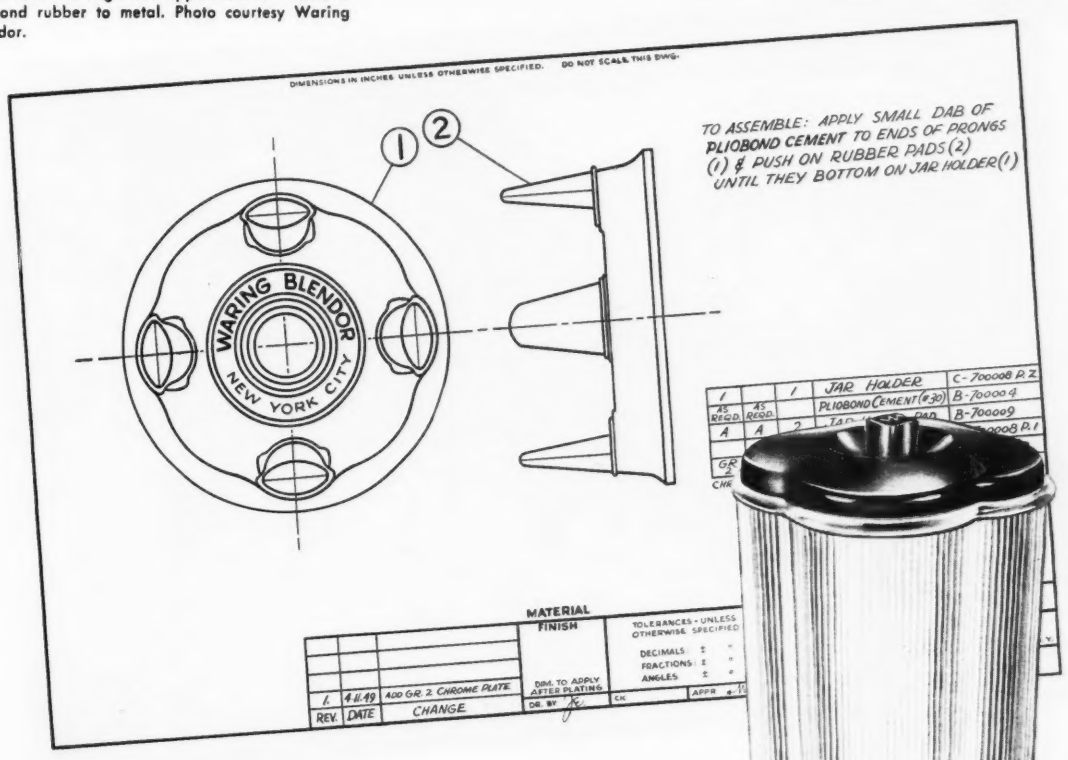
Sample and technical data sent promptly on request

SOUTHERN CLAYS, Inc.

33 RECTOR STREET
NEW YORK 6, N. Y.

ANOTHER ADHESIVE PROBLEM SOLVED WITH *Pliobond*

Photo and drawing show application of PLIOBOND to bond rubber to metal. Photo courtesy Waring Blendor.



"Only cement that does the job"

bonding rubber to die-cast metal

IN making this blender, four rubber fingers are bonded to die-cast metal cores on the base. The production engineer has this to say about easily applied, easily handled PLIOBOND:

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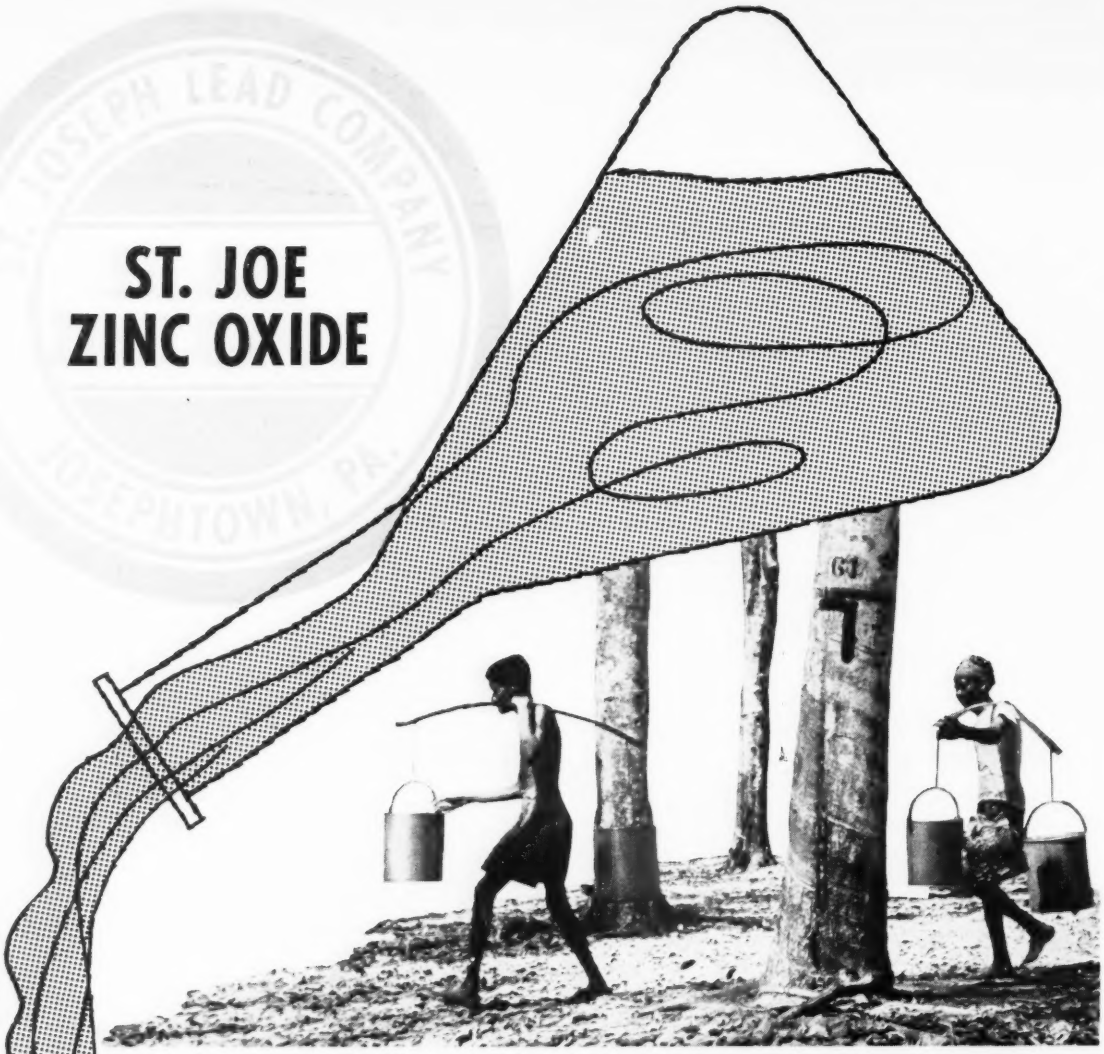

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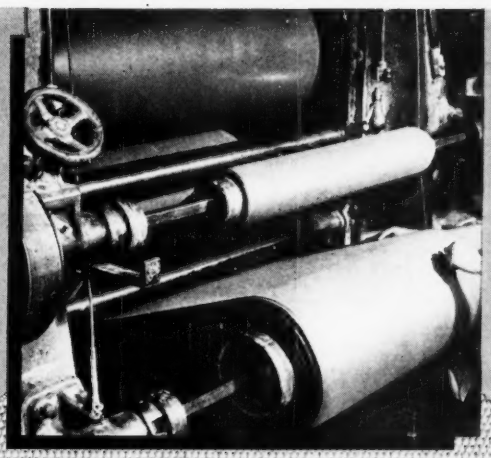

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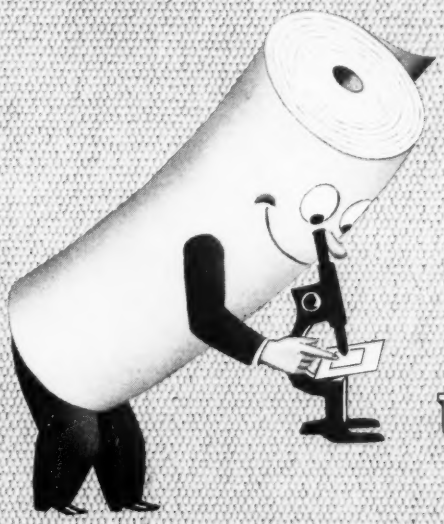

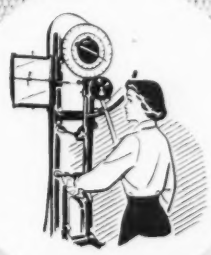

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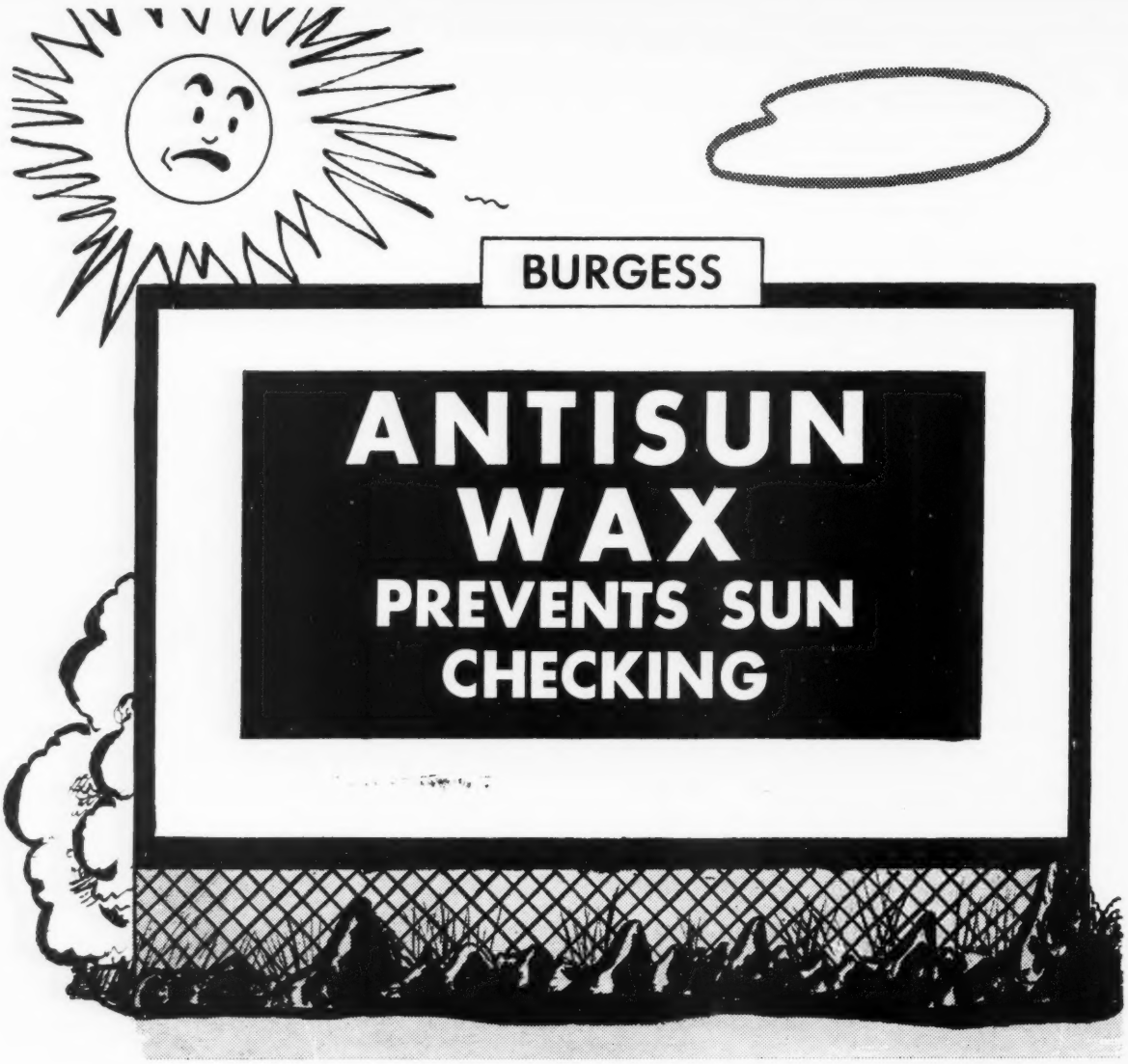

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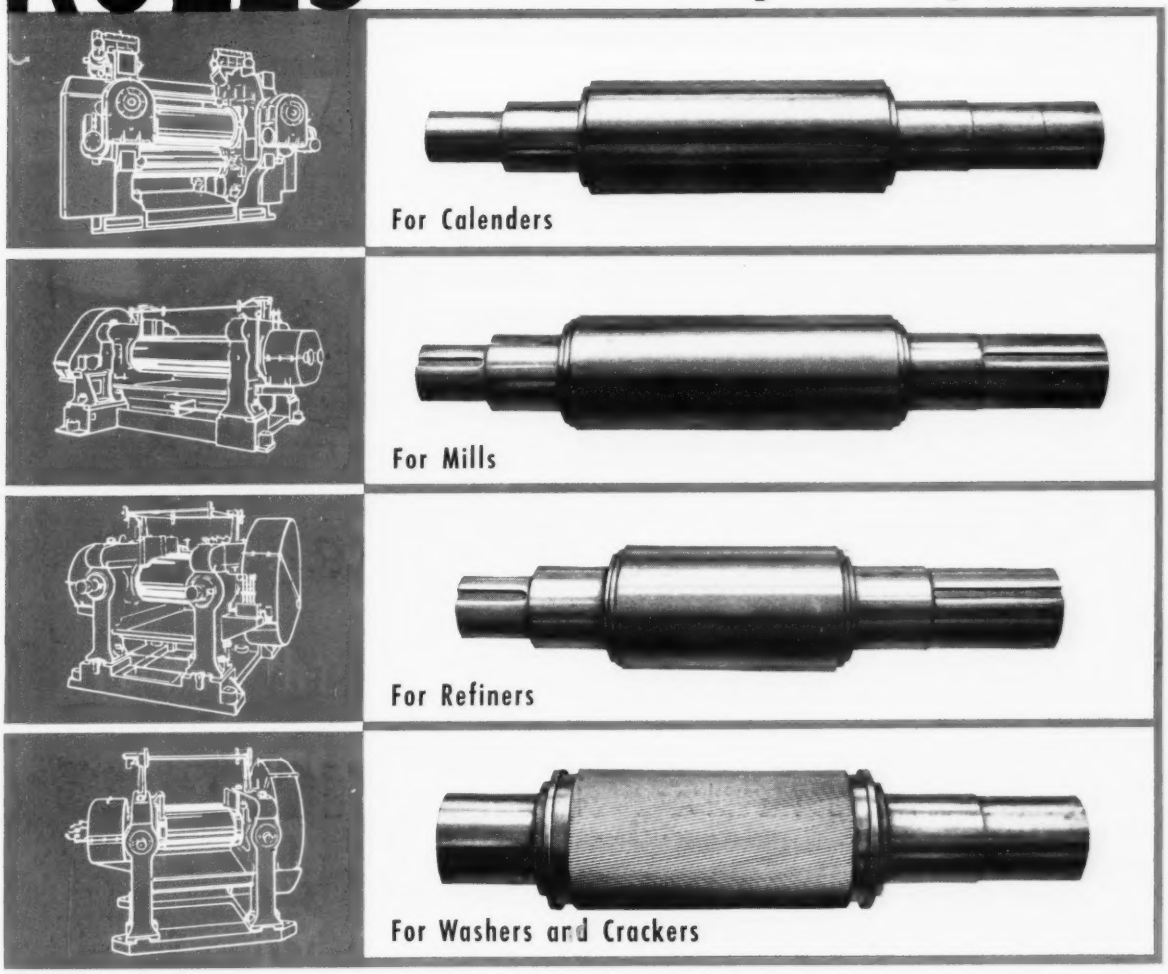

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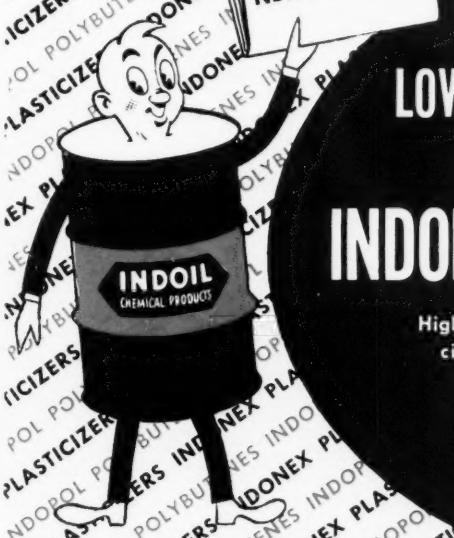

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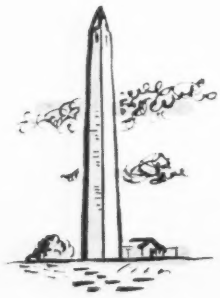

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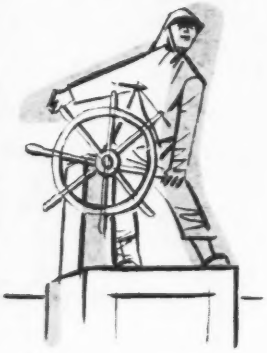

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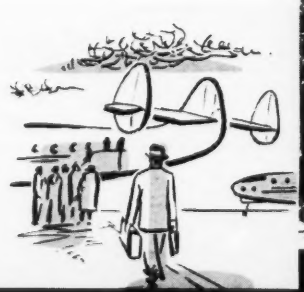

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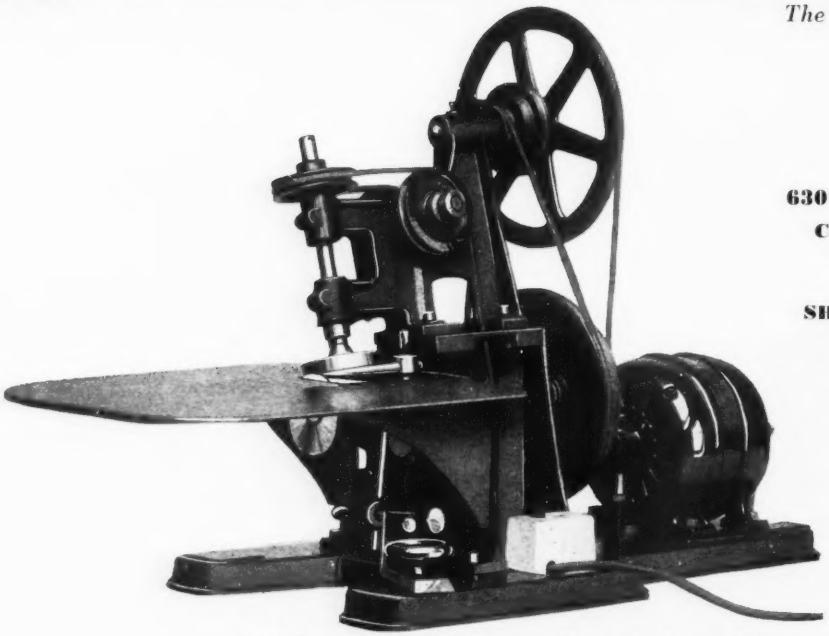

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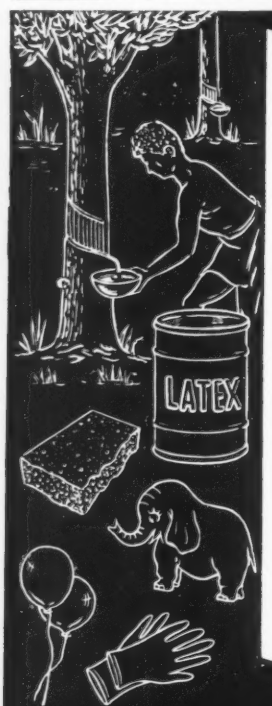

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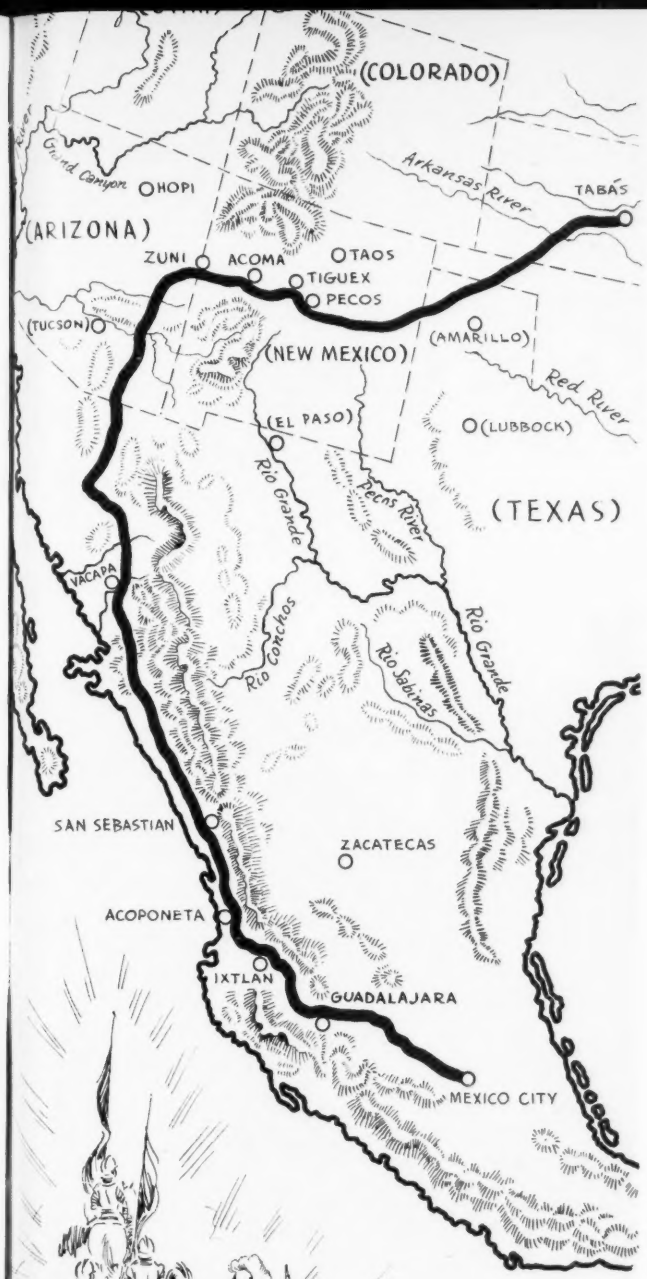

The Trail To The Seven Cities of Gold

The story had come down to the settlement at Mexico City that far to the north there existed "Seven Cities of Gold." In 1540, Francisco Vasques de Coronado, 30 years old, with 300 Spaniards and Indian allies, set out to find this fabulous wealth. Turning northwest, they journeyed to the Pacific, ascended along the coast, through the regions now known as Sinaloa and Sonora, exploring Arizona and New Mexico on the way.

The search for the Seven Cities, after the disappointments in the Southwest, took this brave band to the plains of Texas and Oklahoma. Coronado and his men entered Kansas, reaching a point between the Arkansas and Smoky Hill Rivers. These were the first Europeans to see the Zuni and Hopi Indians, the Staked Plains of the Texas country, the Colorado River and Grand Canyon, the abundant buffalo. They opened up a vast region, previously unknown, but the Seven Cities they sought turned out to be the adobe villages of the Indians, without streets of gold.

Vast were the areas traversed by Coronado and his men; mountain ranges were crossed; the heat and dryness of the desert added to the burden of transporting themselves, their food and weapons. Passing through an unknown land, they followed the trails of the Indians — daily facing perils and danger.

Now, where these fearless men once trod, roadways crisscross in endless patterns. The grandeur of Mexico, the glories of the Southwest and the products of their mines, factories and farms are within the reach of millions, who, like the early explorer, still gaze with awe at the wonders nature has created.

From Mexico City, as from other principal cities of the world, are distributed the carbon blacks made by this Company for the rubber, printing ink, paint and other industries. Carbon black has added greater strength and greater safety to the rubber tire, which in turn has been instrumental in linking communities and nations, where once laborious trails were the barriers to travel and communication.

One in a series of famous trails, a reminder of man's progress in transporting himself and his products.

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Dixie 60 is High Abrasion Furnace Process (HAF) Carbon Black. Detailed attention is given to its manufacture and rigid quality control is constantly maintained.

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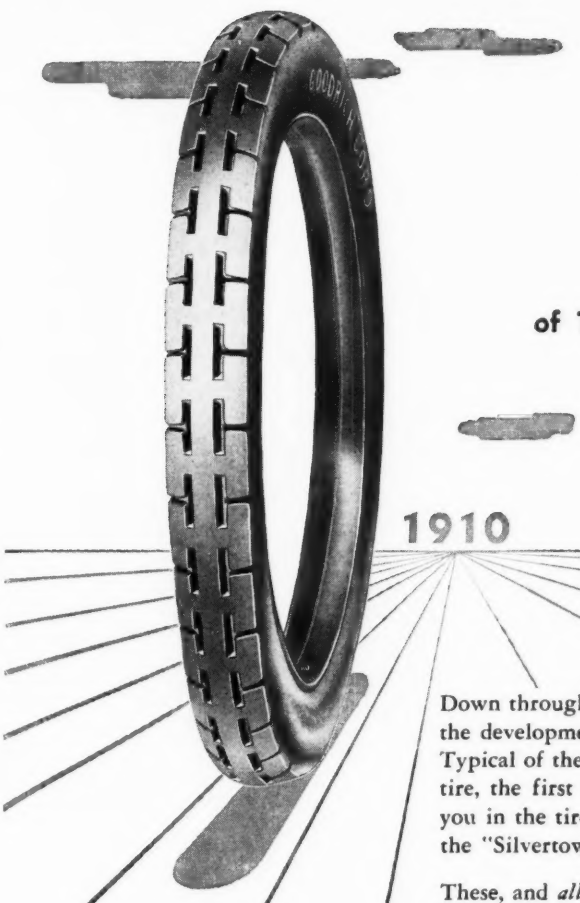

It is the tread
of The B. F. Goodrich Company's
"Silvertown,"
America's first Cord Tire

1910

Down through the years a long line of great "firsts" has marked the development of the automobile tire like shining milestones. Typical of these were such developments as the first straight-side tire, the first non-skid . . . the first balloon . . . And many of you in the tire industry today will remember the first cord tire, the "Silvertown," introduced in 1910.

These, and *all* the great "firsts" in tires are remembered well at Bridgwater, where making molds for automobile tires has been our business for nearly half a century. In fact, many of the great tire "firsts," have come from molds built by Bridgwater. Since 1906 we have worked closely with the tire industry, helping it manufacture higher quality tires by furnishing higher quality molds sturdily constructed for longer service life.

Our Athens Machine Division, in Athens, Ohio, is the only plant in the world whose entire facilities are devoted *exclusively* to meeting the mold requirements of tire manufacturers. Here, the sole occupation of Bridgwater's experienced engineers and skilled metalworking craftsmen is to produce, in engraved steel, cast iron or aluminum, tire molds of any size or type, at costs which tire manufacturers know are decidedly favorable.

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THE BRIDGWATER MACHINE COMPANY

Akron, Ohio

1758

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- Hollow stock can be cut with a minimum of deformation.

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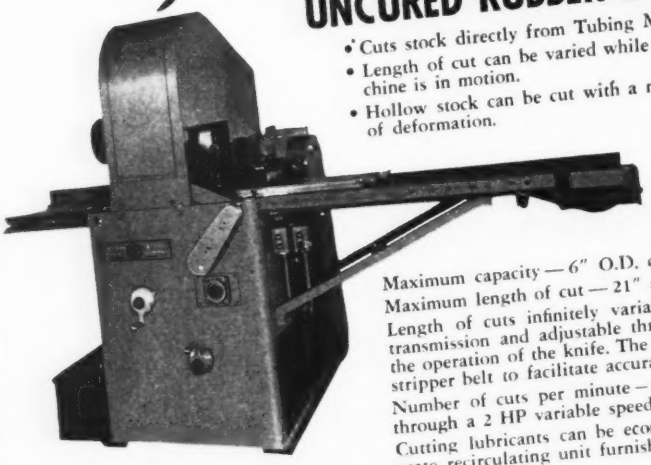
- LESS MAINTENANCE
- LESS WEAR ON MACHINE



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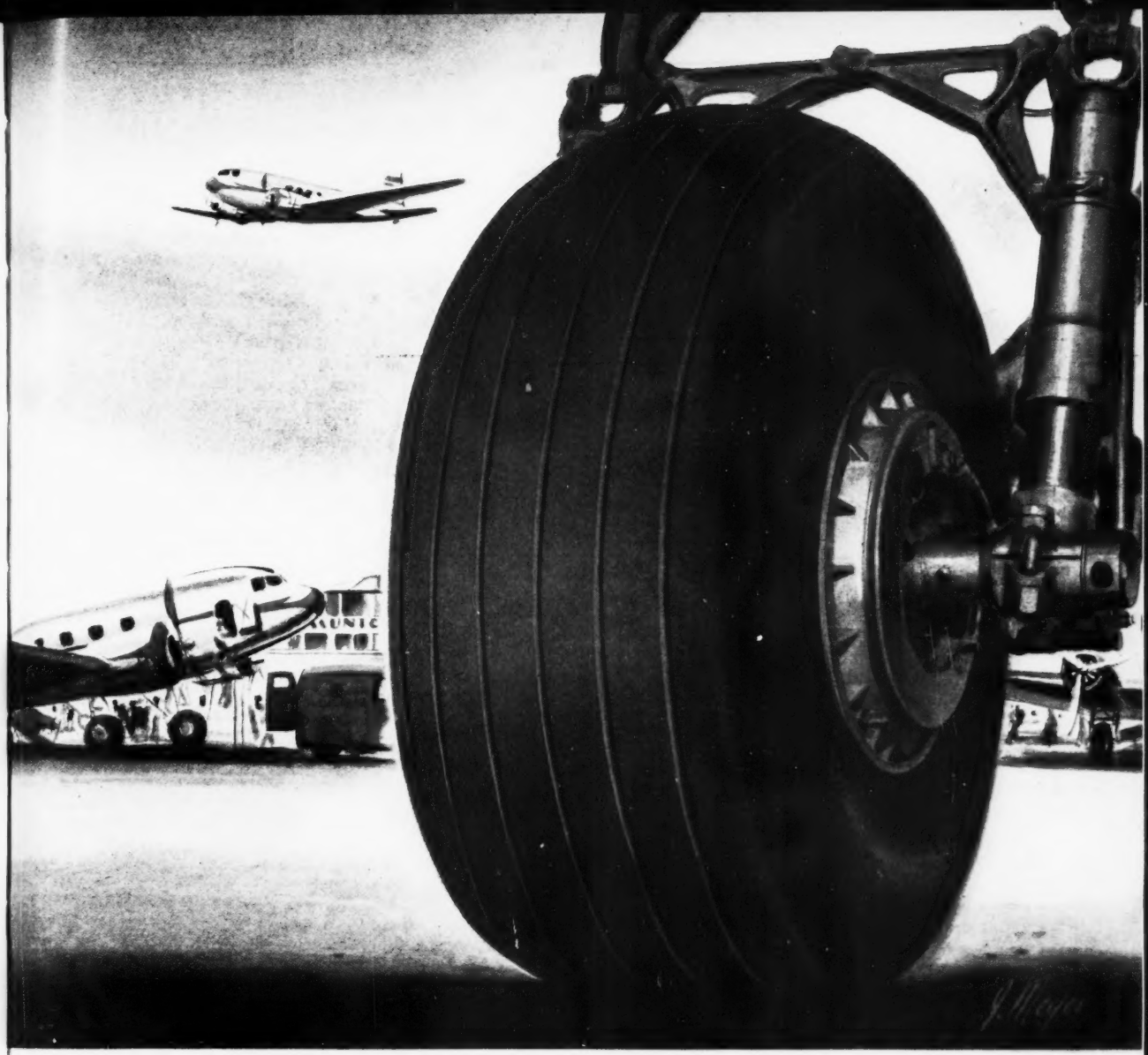

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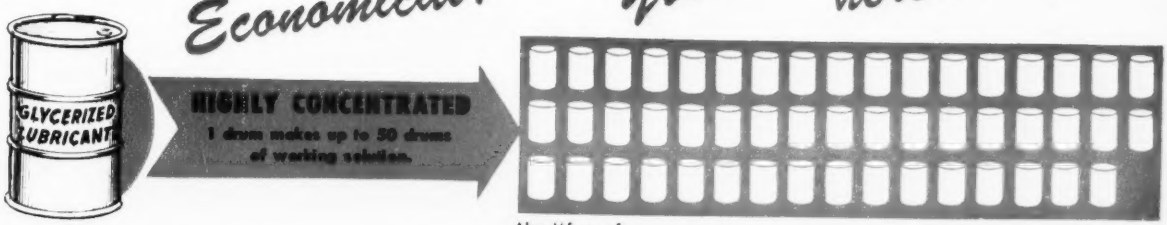
Economical? Yes- here's why:



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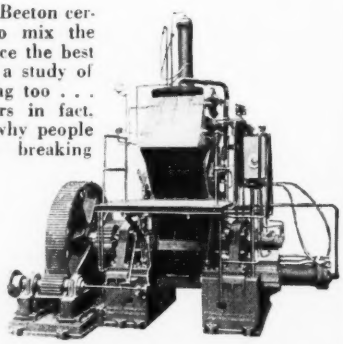

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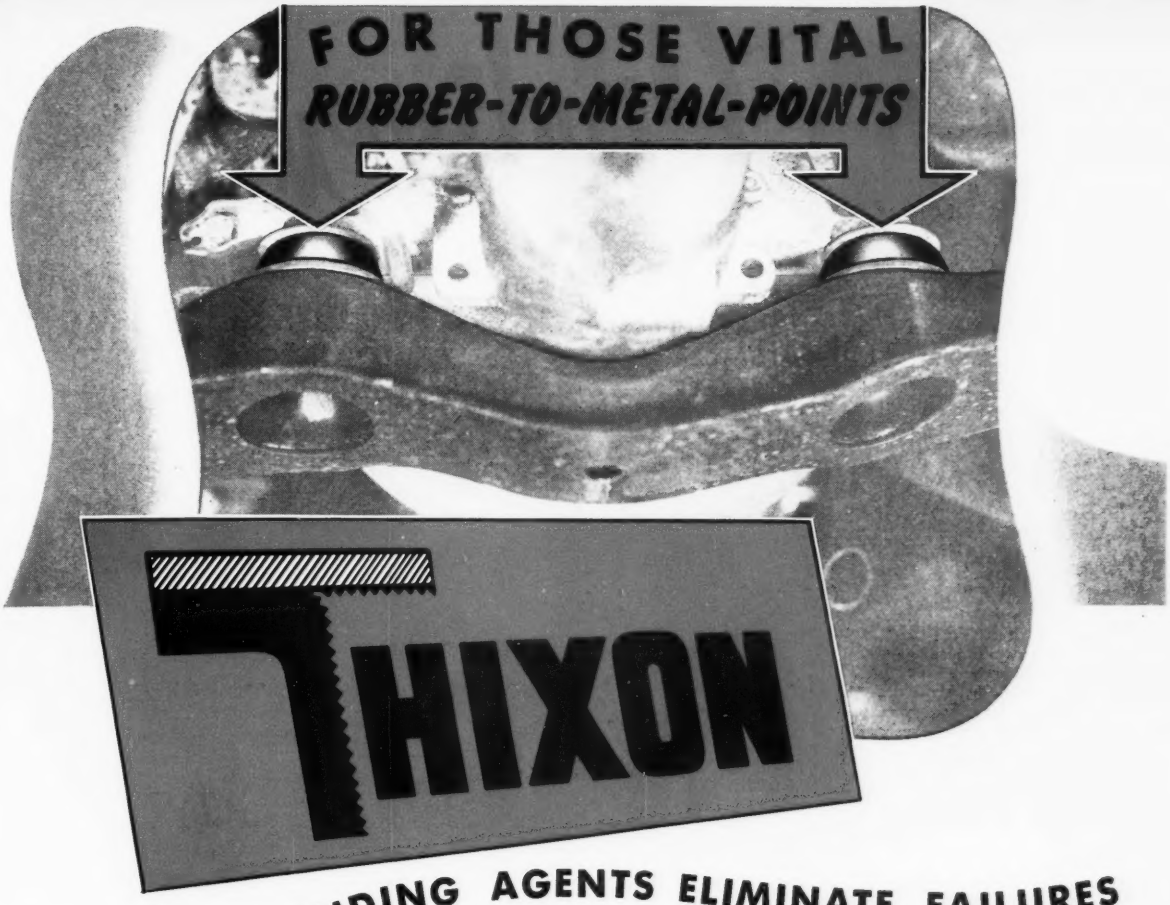

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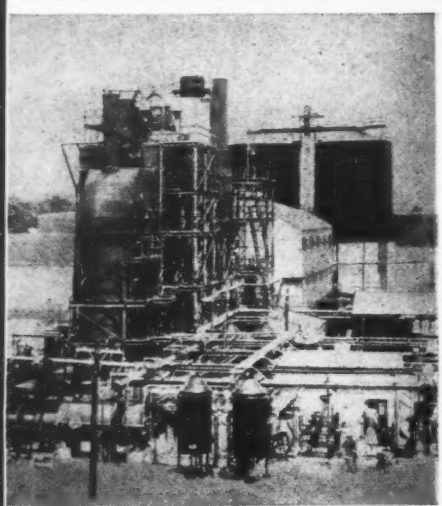

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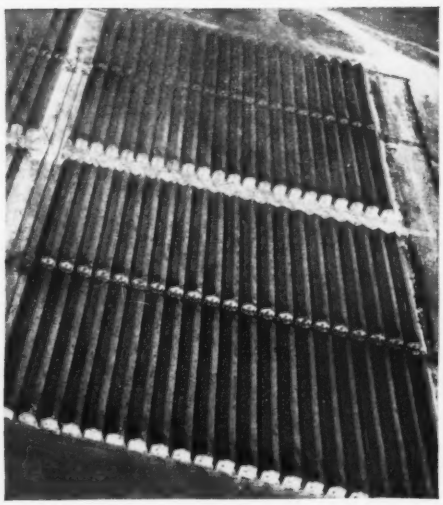

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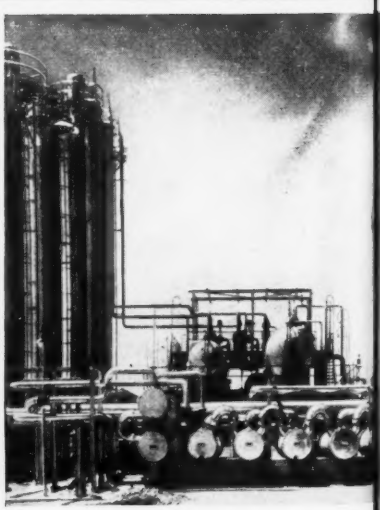

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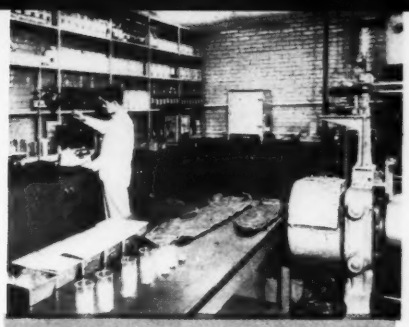
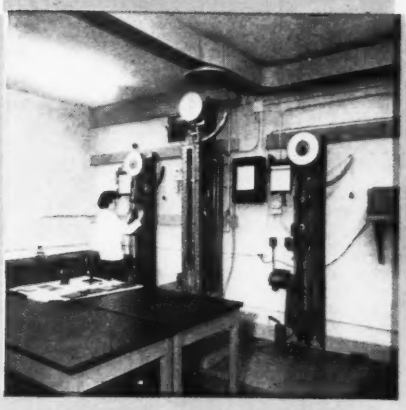
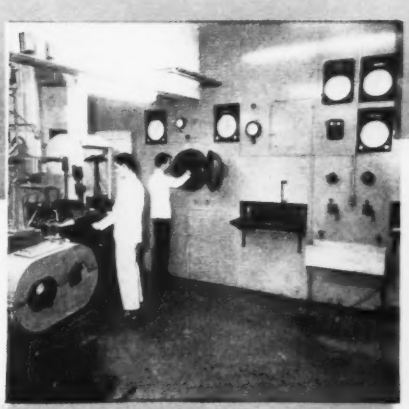


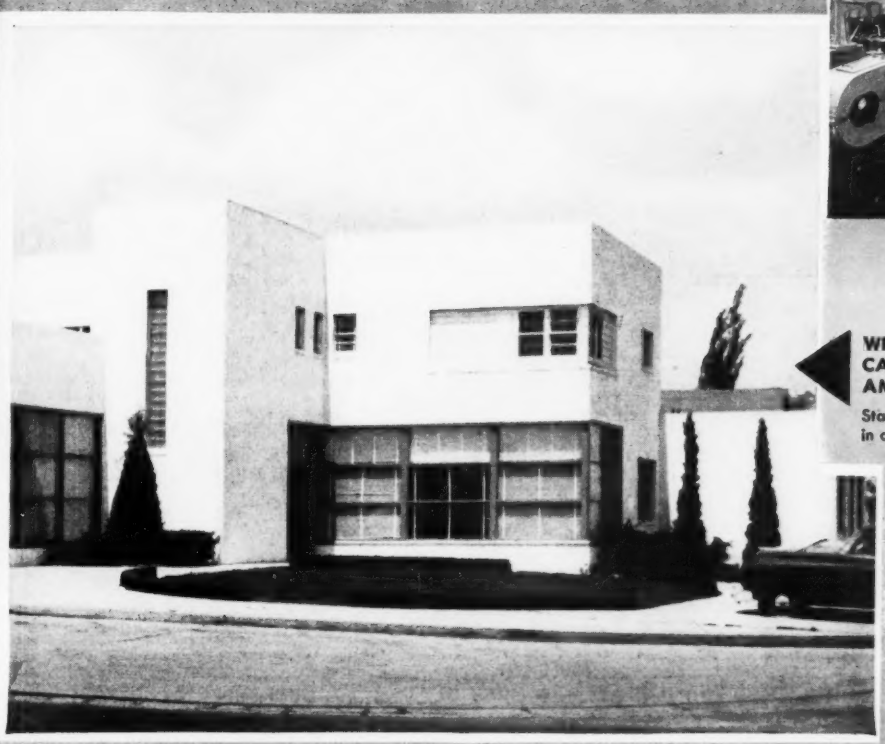
Sectional view of mill room showing compounding of rubber test batches.



Scott Testers for evaluation of rubber compounds; center machine for elevated temperature tests.



Sectional view of laboratory mill room showing rubber mills, open steam vulcanizer, curing presses.



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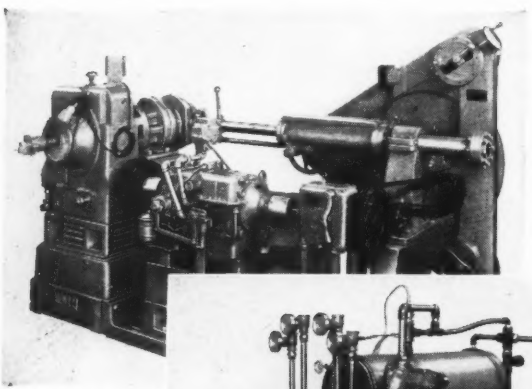

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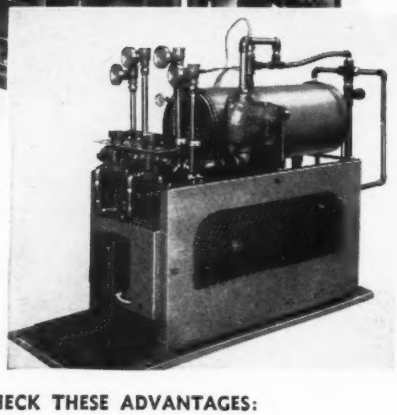

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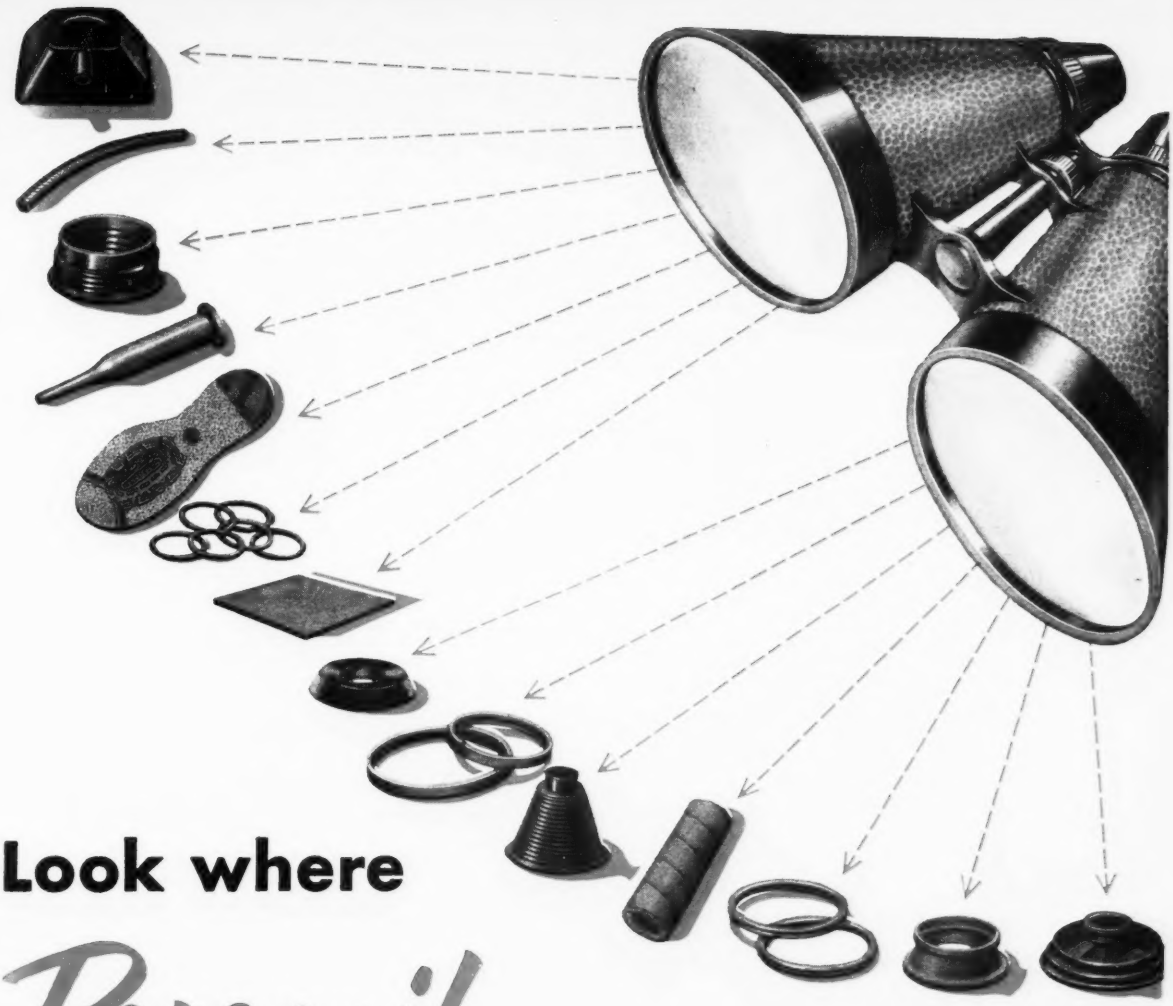

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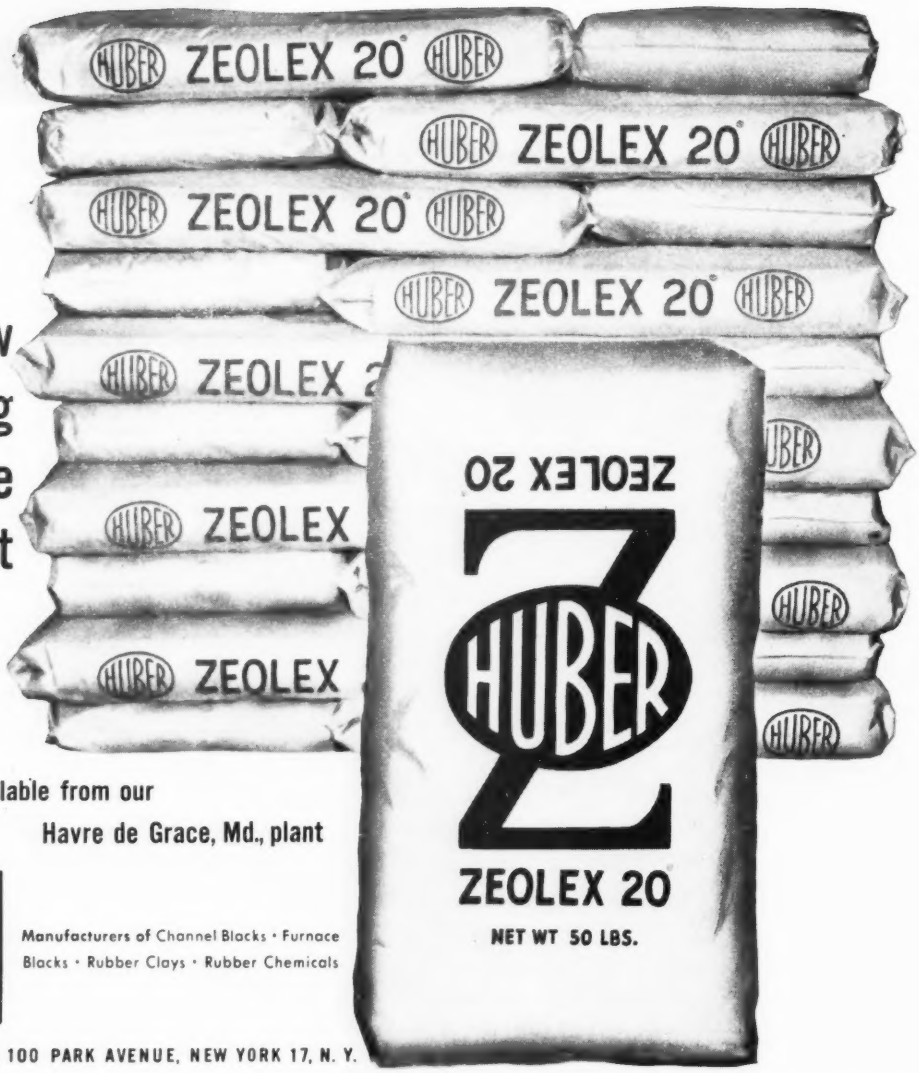

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APRIL, 1953
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VOL. 128—NO. 1 APRIL, 1953

Continuous Emulsion Polymerization in a Tubular Reactor[1]

M. Feldon,[2] R. F. McCann,[2] and R. W. Laundrie[2]

AT THE beginning of the Government Synthetic Rubber Program, it was recognized that continuous and rapid polymerization in a tube (pipe) or annular space between two pipes might be advantageous from the standpoint of greater heat transfer, better quality control, and lower equipment costs. Economy could be realized, of course, only if the better heat transfer would enable a sufficiently high reaction rate to be accommodated to permit satisfactory productivity with a smaller volumetric capacity in the tubular reactor. Also, this high reaction rate would require a much more active catalytic system.

Early Developments

It was originally thought that turbulent flow would be necessary in a tube reactor to assure satsfactory heat transfer and mixing. Without appurtenances such as agitators, orifices, or baffles, this would necessitate a prohibitively long tube even if the reaction times were very short. Accordingly, one of the first pieces of experimental equipment employing the principle of a tubular reactor with turbulent flow and tested by one of the participants in the government rubber program (1)[3] consisted of a series of cylinders each with an agitator. This was not wholly successful, mainly because of precoagulum and fouling, and because, as designed, no advantages were gained over the 12 in line standard reactor system.

Numerous patents (2) claiming the polymerization in tubes of emulsified monomers to elastomers have been issued. During World War II the Germans (3) were experimenting with polymerizations initiated in a reactor followed by tubes wherein the greater part of the reaction took place. Baffles in the tubes to induce turbulence were found to give rise to the formation of precoagulum. Many of the patents specify that turbulent flow is necessary; others are not specific, but imply turbulent flow. In U. S. patent No. 2,394,291 (2), linear flow through a relatively large annular space is recommended.

As far as GR-S type of polymerizations are concerned, knowledge of any tubular polymerization with linear flow prior to these herein reported is not known to the authors. Howland and associates (4) have shown that with turbulent flow through a heat exchanger, polymer of about 40% conversion in limited quantities has been obtained at 41° F. Evidence of precoagulum was apparent.

In May, 1947, at the Government Laboratories a small tubular reactor (5) was constructed which consisted of a vessel equipped with an agitator into which all the ingredients, except the initiator, were charged. The emulsion was made in this vessel and pumped through 50 feet of ⅜-inch O.D. 20-gage tubing jacketed to maintain the desired temperature. The initiator was pumped into the line at a point between the storage vessel and the main feed pump. Rubber was made at 160 to 240° F. in this apparatus by the GR-S-10 persulfate formula in less than two hours (6) and shipped for evaluation in December, 1948. Further work at either 122 or 41° F. in this small apparatus was abandoned because of inaccurate pumping at the very low rates of flow needed for the necessary hold-up time.

Somewhat later, fast recipes were developed for polymerizations of GR-S at 122 (7) and 41° F. (8), and the tubular reactor shown schematically in Figure 1 was built. This continuous displacement reactor, employing linear flow of a premade emulsion of 75/25 butadiene/styrene at 41° F. yielded a latex of 60% conversion only when relatively high activation and soap levels were employed and the initiation was at temperatures above 41° F. All of the successful formulae for use at 41° F. included as the oxidant a hydroperoxide supplied by Hercules Powder Co. The problem of stopping the polymerization reaction in these active systems was solved. As these relatively high soap levels resulted only in special polymers, not direct replacements of the present

[1] The work discussed herein was performed as a part of the research project sponsored by the Reconstruction Finance Corp., Office of Synthetic Rubber, in connection with the Government Synthetic Rubber Program.
[2] Government Laboratories, University of Akron, Akron, O.
[3] Numbers in parentheses refer to Bibliography items at end of this article.

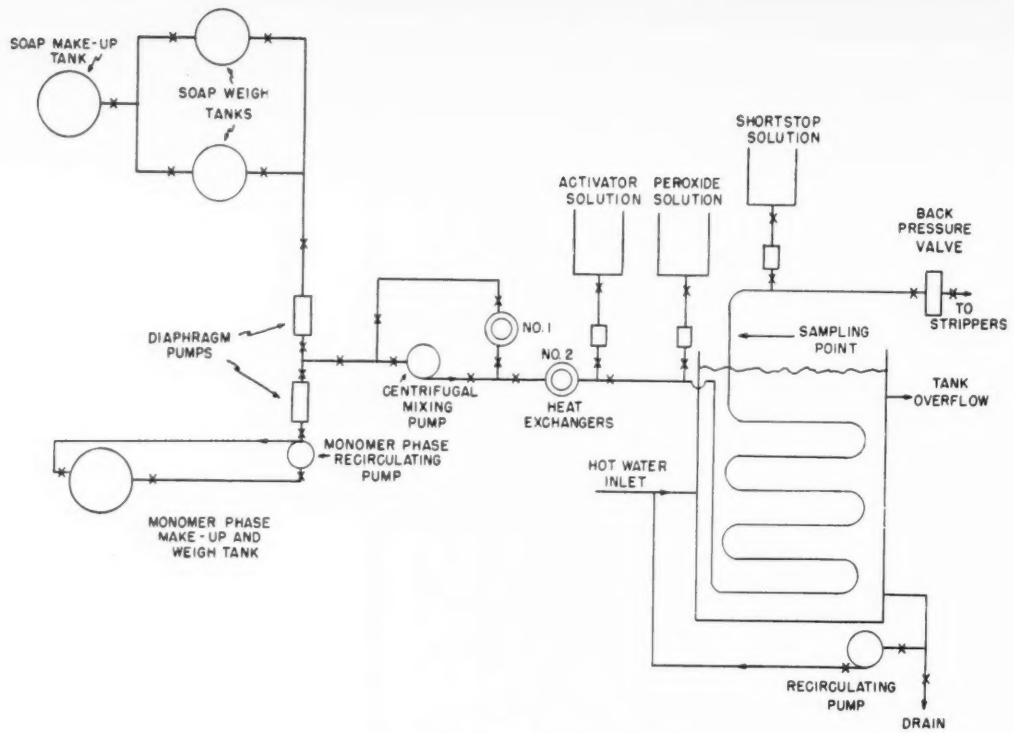

Fig. 1. Schematic Diagram of Tubular Polymerizer

general-purpose commercial GR-S type of polymers made at 41° F., and because formulae had been developed (7) for polymerization at 122° F. capable of being activated to react in 15 to 20 minutes, work was instituted to make polymer at the latter temperature for tire testing.

Approximately 1,500 pounds of a butadiene/styrene copolymer were prepared from a 75/25 BD/S charge polymerized at 122° F. to 73% conversion and 53 ML-4 viscosity by this continuous process with a displacement time of 15 to 20 minutes (8). The polymer, designated as XP-264, was prepared in March, 1952.

Present Procedure and Equipment

The experimental copolymer, XP-264, was prepared according to the following redox formula:

Ingredient	Parts by Weight
Butadiene	75*
Styrene	25*
DDM (commercial n-dodecyl mercaptan)	0.42
Potassium fatty acid soap†	5.0
p-Menthane hydroperoxide	0.20*
Ferrous sulfate heptahydrate	0.080*
Sodium pyrophosphate (anhyd.)	0.60
Dextrose	1.5
Water	200
Shortstop	
Sodium dimethyl dithiocarbamate-sodium polysulfide mixture	0.20
Antioxidant	
Phenyl-beta-naphthylamine (PBNA)	1.5% ‡

*Pure basis.
†Tallow soap meeting Office of Synthetic Rubber specifications.
‡Polymer basis.

The charge ingredients were pumped to the tubular polymerizer in four solutions: (1) soap, (2) monomer-DDM, (3) peroxide-styrene, and (4) activator.

The soap solution was prepared by dissolving the potassium fatty acid soap in 185 parts of water. The butadiene, DDM, and 20 parts of styrene were premixed in a steel weight tank, shown in Figure 1, by recirculating the contents of the tank with a centrifugal pump prior to and during use. The monomer-mercaptan solution was pumped by a diaphragm-type pump into a header into which the soap solution was also introduced by a similar-type pump. The two phases were mixed by recirculating through a high-speed centrifugal pump, and the emulsion was then brought to the desired temperature by passasge through heat exchangers as shown in Figure 1. The activator solution was prepared and then pumped with a positive displacement proportioning pump from a stainless-steel weigh tank into the tube at the outlet of the second heat exchanger. The peroxide was dissolved in five parts of reserved styrene, and this solution, which served to initiate the polymerization, was added to the otherwise completed charge by means of a positive displacement piston-type pump at the inlet of the tube.

The tubular polymerizer consisted of 40 straight sections of 5/8-inch O.D. 20-gage stainless-steel tubing, each of which was 8.83 feet in length, connected by U-shaped sections of 3/4-inch tubing, 0.75-foot in length. The total length of the tubular reactor was 382 feet, and the total volume was 4.9 gallons. The tube was immersed in a 420-gallon tank filled with hot water; the water was maintained uniformly at 122° F. by means of a pneumatic reset controller, and the contents of the tank were recirculated by a centrifugal pump. A constant pressure of 80 lb./sq. in. gage was maintained in the tubular reactor by means of a single-port pressure-activated valve.

The shortstop was added to the latex in the tube at a point immediately beyond the sampling point.

The extent of polymerization was calculated from the total solids contents of shortstopped samples of latex which were removed every 30 minutes and evaporated to dryness.

After 43 days of operation the volume of the tube was unchanged, indicating that polymer did not accumulate on the walls of the tube.

The latex was collected alternately in one of two duplicate strippers; the residual monomers were removed, and

the polymer was stabilized with phenyl-beta-naphthylamine. The latex was salt-acid coagulated, and the polymer was dried at a temperature of 170° F. in forced-draft tray-type driers.

The residence time of the latex from the points of addition of the peroxide to that of the shortstop was 15 to 20 minutes. The conversion was 72 ± 4%, and the Mooney viscosity, 53 ± 5 ML-4.

Polymerization and Rubber Properties

The operation of the equipment was remarkedly trouble-free, and the uniformity of the product was as good as or better than that obtained in a continuous-process pilot-plant unit composed of 12 20-gallon agitated reactors connected in series and using a 12-hour hold-up time (9).

The viscosity of the unvented latex for XP-264 was only 10 centipoises at 122° F., which compares very favorably with that (100 centipoises) for control charges of GR-S made batchwise by a peroxide-dextrose formula (7).

Although the flow in the straight sections of the tube was laminar (the Reynolds number during the preparation of XP-264 was 660 at the inlet), the linear velocity was 21 feet per minute, and the emulsion of the effluent latex at about 72% conversion was stable as indicated by visual inspection, by the absence of polymer build-up on the walls of the tube, and by salt-titration tests. The 0.42-part of DDM required in the tubular system to obtain polymer of about 50 ML-4 viscosity at 72% conversion was substantially less than the 0.55-part required to prepare a similar polymer batchwise from the same raw materials. The polymerization was effectively shortstopped at 72% conversion as indicated by the following data for XP-264:

Butanol-Coagulated Samples Dried "In-Vacuo" at 77° F.			Rapid Mooney Viscosity, ML-4*		Raw Polymer†			
Combined Styrene, %	Gel %	DSV‡	Final	Strip	Combined Styrene, %	Gel %	DSV‡	Mooney Visc. ML-4
21.2	2	2.24	49	49	20.4	4	2.12	53

*Determined on samples of polymer that were isopropanol-coagulated and dried at 220° F. in a laboratory forced-draft oven.
†Salt-acid coagulated and dried at 170° F. in the pilot-plant forced-draft drier.
‡Dilute solution viscosity (0.25% in benzene).

In addition, charges prepared in eight-ounce bottles and shortstopped the same as XP-264 at 36% conversion, exhibited a conversion of 34% after the unvented latex was heated five hours at 122° F.

The chemical properties of XP-264 were almost identical with those of standard GR-S (X-603), except for the expected differences in fatty acid and combined styrene contents caused by the differences in the charges, as indicated by the following data:

Polymer	Ash %	Soap %	Fatty Acid, %	Combined Styrene, %	PBNA %	Gel %	DSV
XP-264	1.38	0.36	5.08	20.4	1.39	4	2.12
X-603	1.11	0.15	4.76	23.6	1.45	2	2.20

The average particle size of the latex for XP-264, as determined by the soap titration method (10), was the same as that of GR-S made batchwise at 122° F. by the peroxide-dextrose formula. The molecular weight distribution of XP-264, as indicated by the dilute solution viscosities, was narrower than that of GR-S made batchwise in reactors equipped with agitators. Both of the stocks made continuously in the series of reactors equipped with agitators (plant and pilot plant) contained more low (0-1 DSV) and high (3-5 DSV) molecular weight polymer than did GR-S made batchwise, as indicated by the following data:

Polymer	Polymerization Method	Visc. ML-4	Fractionated Polymer, % DSV Range 0-1	1-2	2-3	3-4	4-5
GR-S	Batchwise	50	33	27	18	12	10
Plant (X-603)	Continuous	53	36	20	10	15	19
Pilot plant	Continuous	62	36	11	12	41	..
XP-264	Tubular	53	32	13	13	42	..

The compound Mooney viscosities and roughness of XP-264 were somewhat greater than those of plant continuous polymer (X-603), resulting in a slightly poorer mill processing index of 12.4 for XP-264 as compared to a value of 10.2 for X-603 (Table 1). The extrusion characteristics of the mill-mixed experimental polymer were also slightly inferior to those of the control (plant made) stock. The 300% moduli of XP-264 were lower than those of X-603; whereas the elongation values of the experimental stocks were higher; the tensile strength values of both stocks were essentially similar. The lower stiffness of XP-264, as indicated by the 300% moduli at 77° F., were confirmed by the strain data at 77° F. and the stress-strain properties at 212° F.

TABLE 1

	XP-264	X-603
Processing Properties		
Mooney viscosity, ML-4		
Raw	53	53
Compounded	81	62
Mill shrinkage, %	52	52
Roughness	49	24
Mill processing index	12.4	10.2
Extrusion index	6.5	8
Stress-Strain Properties at 77° F.		
300% Modulus, lb./sq. in.	1180	1580
Tensile strength, lb./sq. in.	3070	2990
Elongation, %	550	460
Optimum cure, min.	58	69
Strain Properties at 77° F.		
t_{90}, min.	42	47
Elongation (at 400 lb./sq. in.), %	180	166
Stress-Strain Properties at 212° F.		
200% Modulus, lb./sq. in.	560	....
Tensile strength, lb./sq. in.	650	700
Retention of tensile strength, %	21.2	23
Elongation, %	240	180
Special Physical Properties		
Hysteresis temp. rise, °F.	52	52
Set, %	13.2	13.2
Flex-life	2000	2000
Quality index	0.9	0.9
Rebound, %		
At 77° F.	56	56
At 212° F.	68	69
Gehman values, minus °C.		
T_2	31	26
T_{10}	50	44
T_{100}	56	52

Test Conditions:
Compounding receipe: 100 polymer, 40 EPC black, 5 zinc oxide, 2 sulfur, 1.75 Altax. The stocks were cured at 292° F.
Mooney viscosity: 4-minute reading, large rotor, 212° F.
Roughness according to the procedure outlined by M. Mooney (11).
Mill processing index by method of Schade and Labbe (12).
Extrusion index according to procedure of Garvey, *et al.* (13).
Stress-strain tests: OSR specification procedure January 1, 1949. Data obtained at 77 and 212° F. on vulcanizates nearest the optimum cure, as judged from the 300% modulus.
The "preferred" cure time: $t_p = t_o + 0.68\sqrt{1/k}$ (14).
Hysteresis temperature rise: Goodrich flexometer; 143 lb./sq. in. load; 0.175-inch stroke; 1800 r.p.m., 30-minute test at 212° F. Samples at optimum cure.
Flex-life: DeMattia flexometer; pierced specimens; data reported as number of flexures to produce 0.8-inch crack growth at 312 cycles per minute and 212° F. Samples at optimum cure.
Quality index: ratio of flexures of test sample to flexures of GR-S at equal hysterimeter values.
Rebound: Goodyear-Healy pendulum method; angle of inertia 15 degrees; Shore hardness, five-second reading with Shore Type A durometer. Data are for specimens cured for 30-minutes beyond the optimum.
Gehman low-temperature test as described in (15); specimens cured the same as those for the rebound test.

Specimens of XP-264 that were cured for the optimum time and exhibited set values comparable to those of X-603 also had similar hysteresis and flex-life properties. The percentage rebound of the experimental and control stocks were almost identical. The Gehman low-temperature properties of XP-264 were, as expected from the

(*Continued on page 63*)

Chlorosulfonated Polyethylene[1]–II

Metal Oxide Curing Systems[2]

M. A. Smook,[3] I. D. Roche,[3] W. B. Clark,[3] O. G. Youngquist[3]

THE first paper in this series[4] told of the composition and properties of a few typical "Hypalon" chlorosulfonated polyethylene compounds and some potential applications. This paper will discuss the mechanism of the metal oxide cures in more detail and will show some of the effects of variations in compounding ingredients on outstanding properties.

The curing systems which have been studied most intensively for chlorosulfonated polyethylene are based on a polybasic metal oxide or a polybasic metal salt of a weak acid, an organic acid, and an organic accelerator. The omission of any of the three basic ingredients in the curing formula results in inferior vulcanizates. Although the amount of each individual component may be varied considerably, a lower limit for each exists below which physical properties of the vulcanizates suffer. A typical formula (Table I) will include (per 100 parts of elastomer) about 10 to 50 parts of a metal oxide, depending on its molecular weight and density, two to 10 parts of an organic acid, and ¼-part to three parts of an accelerator.

TABLE I. TYPICAL CURING FORMULAE

"Hypalon"	100	100
Magnesia (MgO)		20
Litharge (PbO)	40	
"Staybelite" Resin	10	2.5
"Tetrone A"		1
MBT (mercapto benzothiozole)	1	

Mechanism of Curing Reaction

The main cross-linking reaction in this metal oxide system is believed to be the reaction between the metal oxide and sulfonic acid groups from the polymer chain. The first step in the cure is then necessarily the hydrolysis of sulfonyl chloride groups to the free acids. The second step is the formation of a sulfonate bridge. A series of equations has been postulated to explain the curing reaction taking place.

$$2\,RSO_2Cl + 2\,H_2O \longrightarrow 2\,HCl + 2\,RSO_2OH$$

$$PbO + 2\,HCl \longrightarrow H_2O + PbCl_2$$

$$PbO + 2\,RSO_2OH \longrightarrow H_2O + (RSO_2O)_2Pb$$

$$2RSO_2Cl + 2PbO \longrightarrow PbCl_2 + (RSO_2O)_2Pb$$

Postulated Curing Reaction

Several pieces of evidence substantiate the above sequence of steps. This mechanism explains the safe processibility of chlorosulfonated polyethylene compounds containing curing agents, since the sulfonyl chloride groups will not react with the metal oxide. The cross-linking reaction takes place at significant rates only under curing conditions where water is formed, and the rate of hydrolysis of the sulfonyl chloride group to the sulfonic acid group is rapid. When all the ingredients in the formula are completely dry, or if enough diesiccant, such as calcium oxide, is added to the formula, little or no cure is obtained under normal curing conditions. On the other hand, the rate of cure determined in a variety of ways is accelerated very markedly by the addition of water to the formulation. This is shown graphically in Figure 1 by a plot of Mooney scorch time against the percentage of water in the compound. Water was incorporated in the stock by soaking the Mooney test samples for an appropriate time. The amount was determined by weight difference. From the mechanism postulated it can be seen that water is necessary only in the role of a catalyst or for the formation of intermediates. The presence of more or less water only affects the rate of the cross-linking reaction and not the extent of the reaction.

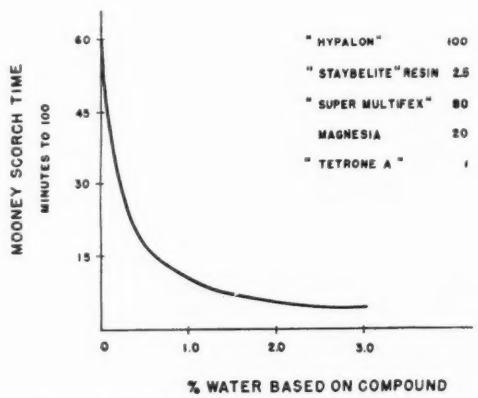

Fig. 1. Mooney Scorch Time *versus* Water Content of "Hypalon" Stocks

If polymer containing hydrolyzed sulfonyl chloride groups (i.e., sulfonic acid groups) is used in compounding, the rate controlling step has already taken place, and cross-linking is very rapid. A few other materials have the same effect as water in chlorosulfonated polyethylene stocks. Hydrated salts such as calcium silicate, which release water at processing temperatures, react like water itself. Alcohols and polyhydroxyl compounds like sorbitol have an accelerating effect similar to water in these metal oxide systems. Alcohols are known to react with short-chain alkane sulfonyl chlorides to yield free sulfonic acids.

[1] Distributed as "Hypalon" chlorosulfonated polythene. "Hypalon" is a registered trade mark of E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.

[2] Presented before the Division of Rubber Chemistry, A. C. S., Cincinnati, O., Apr. 30, 1952.

[3] Polychemicals department, du Pont Experimental Station, Wilmington.

[4] See our Mar., 1953, issue, p. 791.

One method of changing the relation between the rate of cure and the water content of the stock is by irreversibly adsorbing part of the water, making it unavailable for reaction. The addition of channel black to a stock will shift the curve of Mooney scorch time *versus* water content to the right (Figure 2). Therefore a longer time is required to cure a black loaded stock of a given water content than a similar compound containing no black.

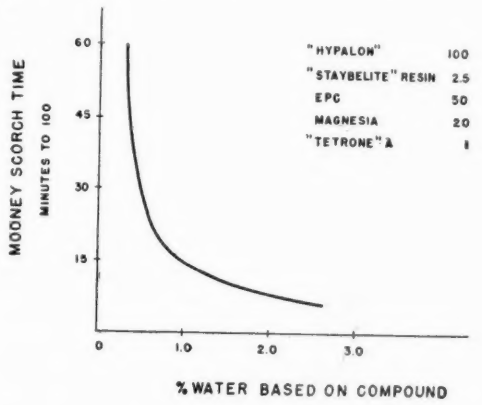

Fig. 2. Mooney Scorch Time *versus* Water Content of Black "Hypalon" Stocks

An interesting demonstration of the role of water in the cure of chlorosulfonated polyethylene was obtained in the following way. All the ingredients in the curing formula including the polymer were scrupulously dried, and the material was compounded. Sheets approximately 75 mils thick were pressed for three minutes at 100° C. Samples of the pressed slabs were tested for tensile properties, then were stored under three conditions: at 50% relative humidity and 50° C., at 50% relative humidity and 23° C., and in a desiccator at 23° C. Weight gain was measured periodically, and tensile properties were followed as an indication of the state of cure. Figure 3 shows that essentially no cure took place in the absence of water; while fairly rapid cure was effected even at 50° C. in a moist atmosphere.

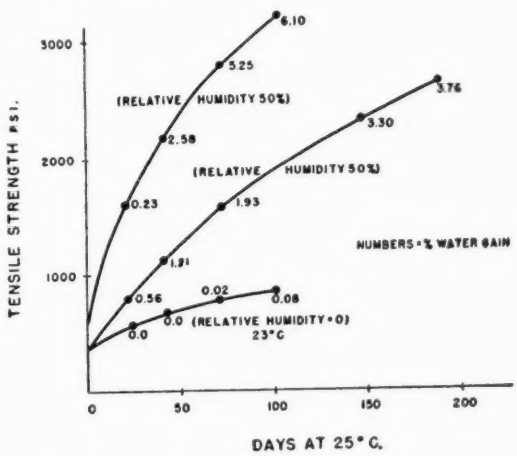

Fig. 3. Effect of Moisture on Rate of Cure as Measured by Tensile Strength

Curing Agents

A variety of basic materials, both organic and inorganic, have been found effective in increasing the rate of cure. These bases, which include pyridine and sodium acetate, as well as the familiar accelerators, diphenylguanidine and the di-orthotolylguanidine salt of dicatechol borate, probably function as catalysts to increase the rate of sulfonyl chloride hydrolysis. The use of the above materials provides a method of obtaining any desired curing time.

Any of the typical phenolic-type antioxidants have an accelerating effect on the metal oxide cure by virtue of the hydroxyl groups present. This acceleration can be clearly demonstrated by Mooney scorch curves. Since the process of aging may be regarded, in part, as overvulcanization, materials which increase the cure rate may be expected to contribute to poorer aging. Phenolic antioxidants do, in fact, decrease the age resistance of chlorosulfonated polyethylene compounds; so care must be exercised in selecting the proper type of antioxidant.

As previously mentioned, an organic acid is included in all preferred curing formulations. Although the function of the acid is not known with certainty, it is believed to react with the metal oxide to solubilize the metallic ion and release water.

$$2\,RCOOH + PbO \longrightarrow (RCOO)_2Pb + H_2O$$

Initial Metal Oxide Reaction

It probably also aids in dispersion. Weakly acidic materials are necessary, since strong acids probably compete with the sulfonic acid groups in the polymer for reaction with the metallic salt, resulting in a retardation or complete inhibition of the cure. Rosin acids have proved the most effective of a number of aliphatic and aromatic acids tried in our compounding formulae. In general, the long-chain aliphatic acids, such as stearic, are only slightly less effective. Aromatic acids usually were either incompatible or gave unsatisfactory results. We find abietic acid is no better than crude rosin, but hydrogenated rosins, such as "Staybelite", are preferred in light-colored stocks. Materials such as hydroxylated wood rosin may lead to scorchy stocks in some recipes. Decomposition of unsaturated rosin acids can contribute to discoloration in light-colored compositions.

A wide variety of metal oxides and salts has been used in curing recipes, and a large number has been found to be reactive (Table 2). Many of these compounds were not of practical importance, however, for one reason or another. Cadmium and mercuric oxides were obviously too expensive. Aluminum oxide gave compositions of extreme water sensitivity. Stocks cured with the stearates developed a waxy bloom after several days. Zinc and iron salts were very heat sensitive and either decomposed the polymer during vulcanization or contributed to extremely poor heat aging. From a practical consideration magnesia and litharge were the best curing agents found. For some special applications where color stability is of prime importance, several other lead salts offer an advantage over litharge. Chlorosulfonated polyethylene cured with tribasic lead maleate or lead phosphite has most of the typical properties of a litharge cure and, in addition, maintains its light color after vulcanization even when not protected by light pigments. Litharge stocks can be made white also, if they contain sufficient titania, and curing temperatures are kept low.

Table 2. Oxides and Salts With Curing Activity

Lead monoxide	Aluminum stearate
Red lead oxide	Zinc oxide
Lead peroxide	Barium oxide
Stearate	Calcium hydroxide
Tribasic lead maleate	Ferrous oxide
Basic lead carbonate	Ferric oxide
Lead phosphite	Calcium carbonate
Magnesium oxide	Cadmium oxide
Aluminum oxide	Mercuric oxide

A several-fold stoichiometric excess of metal oxide over that required for reaction with the sulfonyl chloride groups seems necessary. This is probably due to the relatively large particle size of the oxide agglomerates and their insolubility in the polymer. The presence of excess oxide has a stabilizing effect on the composition too, since any hydrochloric acid which might split out of the polymer chain is immediately neutralized.

Particle size of the metal oxide is important in determining the rate of cure. About 40 parts per 100 of polymer of a sublimed litharge of two-micron particle size give satisfactory processing safety and good vulcanizates. A similar quantity of litharge having an average particle size of only one micron gives a fast curing, scorchy stock. A rate of cure identical with that obtained from the larger particle sized litharge was obtained from a compound containing 25 parts of the finer litharge. So far, stocks cured with only 25 parts of litharge have failed to give age resistance comparable with compositions of higher litharge contents.

Magnesia has some advantages over litharge as a curing agent for chlorosulfonated polyethylene. Less magnesia by weight is required for optimum properties. Its light color favors its use in white or pastel-colored stocks. Because magnesia is completely non-toxic, its use is recommended whenever food sealing or packaging is contemplated.

The most important advantage of litharge cured compounds is their extreme water resistance. Also the resistance of these stocks to oven aging and outdoor weathering is somewhat superior to comparable magnesia cured compositions. The litharge stocks are also somewhat softer and faster curing.

Effect of Sulfonyl Chloride Pyrolysis on Cure

A side reaction during the cure of chlorosulfonated polyethylene is the familiar pyrolysis reaction of sulfonyl chlorides shown in

$$RSO_2Cl \xrightarrow{\Delta} RCl + SO_2$$

Pyrolysis of Sulfonyl Chlorides

It has been pointed out by Asinger *et al.*[5] that the yield of alkyl chlorides by this method is nearly quantitative. The ease of desulfonation is dependent on whether the sulfonyl chloride group is primary, secondary, or tertiary. Most of the groups are probably secondary in chlorosulfonated polyethylene, and they can be liberated quantitatively in about 10-12 hours at 150 to 175° C. This desulfonation can be made to take place also in about two hours at 140° C. in the presence of a catalyst such as ferric chloride, aluminum chloride, or peroxides. The pyrolysis and hydrolysis reactions are in competition with each other during curing treatment. If enough water is present in the compounded formulation to accelerate the hydrolysis reaction, very little pyrolysis will take place, since the rate of pyrolysis is relatively slow at normal curing temperatures. When the compound is dry, however, and it is exposed to curing temperatures for a prolonged period, it will lose an appreciable amount of SO_2 by pyrolysis. This gassing results in blown or sponged cross-sections in the cured sample. Once the cross-link has been formed through the sulfonic acid functional group, that particular group is probably stabilized against further pyrolysis.

[5] Asinger, Schmidt and Streigler, Office of Technical Services Report, PB 850, (1941), U. S. Dept. of Commerce, Washington, D. C.

In addition to sulfur dioxide loss at elevated temperatures, hydrogen chloride is also evolved. Either of two reactions

$$1.\ -CH_2-CHCl- \xrightarrow{\Delta} -CH=CH- + HCl$$

$$2.\ -CH_2-CHSO_2Cl- \xrightarrow{\Delta} -CH=CH- + HCl + SO_2$$

Loss of Hydrogen Chloride

may account for this hydrochloric acid. One possibility is simple splitting of hydrogen chloride from the chain, as with polyvinyl chloride. The other reaction involves the loss of sulfur dioxide and hydrogen chloride simultaneously from a sulfonyl chloride group. In either case an acid acceptor must be available to immobilize the free acid. If no acid acceptor is present, or if water soluble chlorides are formed, the compound is susceptible to attack by water.

Effect of Organic Accelerators on Cure

The exact function of the accelerator in curing chlorosulfonated polyethylene is not well defined. Certain of the accelerators, particularly those containing sulfur, have some curing activity when used alone in the polymer. A further discussion of these organic curing agents will be given in Part III. Since the loss of even a small amount of hydrogen chloride would provide sites for possible accelerator cross-linking of the polymer, it is possible that these reagents contribute a secondary cure in the cross-linking mechanism.

A large number of accelerators are effective in chlorosulfonated polyethylene curing formulations. Mercaptobenzothiazole, benzothiazyl disulfide, and dipentamethylene thiuram tetrasulfide have been most frequently used in our work, but the dithiocarbamates and thiuram disulfides are also satisfactory. Aldehyde-amine condensation products are extremely scorchy and give compounds of poor strength. As previously mentioned, basic materials may be used as super-accelerators to increase the rate of cure.

As with all other elastomers, the physical properties obtainable with chlorosulfonated polyethylene are to a large extent dependent on the compounding recipe used. Formulating, however, is only part of the story. More important are the inherent properties of the polymer itself, which determine the properties of the vulcanizates.

Aging and Other Physical Properties

The fully saturated structure of chlorosulfonated polythylene is probably largely responsible for its characteristic resistance to most degradative forces. Regardless of the curing recipe used, chlorosulfonated polyethylene is extremely resistant to ozone. To date, no failures have been experienced either in accelerated laboratory tests or upon outdoor exposure. Samples cured with a number of different recipes remained unchanged after exposure to 150 ppm. ozone for 14 hours. Butyl rubber and neoprene, known for their ozone resistance, show visible cracking within a few hours under the same conditions. Tests conducted at ozone concentrations of 25 parts per hundred million gave the same results after longer exposure times.

Although all chlorosulfonated polyethylene vulcanizates, regardless of cure, are ozone resistant, some care must be exercized to obtain the optimum heat and oxygen resistance. The aging phenomenon in most elastomers has been shown to be a combination of oxidative degradation and continued vulcanization. Antioxidants do

much to interrupt the former process, but the latter continues, ultimately destroying the elastomeric properties altogether. In the case of natural rubber and GR-S the oxidative effect is particularly apparent in the brittle surface formed during aging. Chlorosulfonated polyethylene probably does not suffer much oxidation in the aging process. Little surface hardening is observed, and the saturated structure of the polymer would tend to minimize oxidation. Most of the change in properties observed probably results from continued cure during aging. Actually the aged properties of most compositions after 28 days of exposure at 100° C. in an air oven or after similar exposure in an oxygen bomb at 70° C. are good without any special compounding (Table 3).

TABLE 3. AGING OF TYPICAL CHLOROSULFONATED POLYETHYLENE COMPOUNDS

"Hypalon"	100	100
"Staybelite" resin	2.5	10
Tri-Mal (tribasic lead maleate)	37.5	....
Litharge (lead oxide)	....	40
Ti-Pure R 110 (titanium dioxide)	114	....
SRF Black	....	39.4
MBT (mercapto benzothiazole)	2	3
Initial		
Tensile psi.	1975	2580
% Elongation	370	295
Aging 28 days at 100° C.		
Tensile psi.	2840	3400
% Elongation	175	165
Aging 28 days O_2 Bomb 70° C. 300 psi.		
Tensile	2115	3230
% Elongation	225	180

As previously mentioned, phenolic-type antioxidants decrease age resistance in chlorosulfonated polyethylene stocks. A variety of other typical rubber antioxidants is also ineffective in improving this property. On the other hand, certain of the secondary-amine antioxidants are extremely effective in improving the aging performance in litharge cured stocks, but not in magnesia cured stocks. From the selectivity of these materials, which include N,N'diphenyl paraphenylenediamine and polymerized trimethyl dihydroquinoline, it seems fairly apparent that they are not functioning primarily as antioxidants. We have shown that these materials actually act as inhibitors in the lead oxide system, and it is probable that through slowing the cure rate of the compositions they effectively improve aging. Samples of chlorosulfonated polyethylene cured in a typical litharge recipe with an antioxidant from the group above age so well at 100° C., that temperatures of 125° C. have been used for test purposes. At this temperature after seven days one compound containing polymerized trimethyl dihydroquinoline lost about 30% of its elongation, while increasing in tensile strength (Table 4). The aged sample had a tensile strength of 2415 psi. and an elongation of 240%.

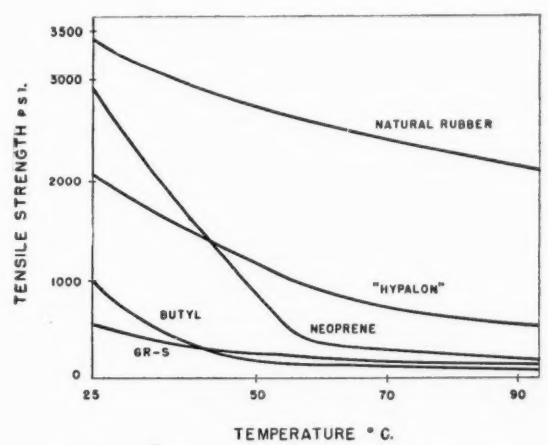

Fig. 4. Tensile Strength of Gum Stocks of Various Rubbers at Elevated Temperatures

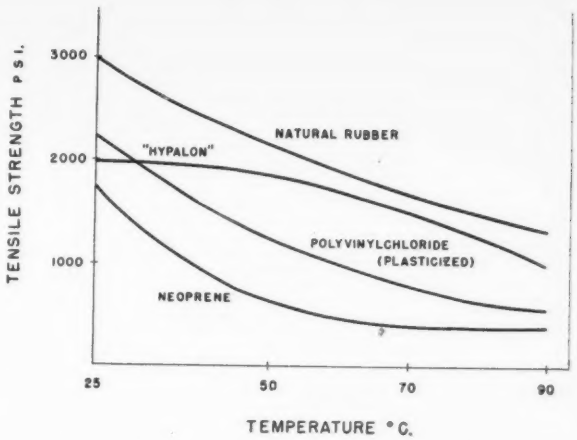

Fig. 5. Tensile Strength of White Stocks of Various Rubbers at Elevated Temperatures

TABLE 4. EFFECT OF POLYMERIZED TRIMETHYL DIHYDROQUINOLINE ON AGING OF "HYPALON"

	M-1274	M-1351
Hypalon	100	100
Staybelite Resin	10	10
"Ti-Pure" R 110 (titanium dioxide)	60.5	60.5
Litharge (lead oxide)	40	35
MBT (mercapto benzothiazole)	2	2
AgeRite Resin D (polymerized trimethyl dihydroquinoline)	2	....
Cure 30 min. at 160° C.		
Initial		
Tensile psi.	2120	2225
% Elongation	350	390
7 days aging, at 125° C.		
Tensile psi.	2415	1185
% Elongation	240	85

Most elastomers degrade very rapidly on exposure to a combination of ultra-violet light and oxygen. This behavior probably explains the degradation experienced during severe weathering. This oxidation can be slowed down, but not prevented, by the presence of ultra-violet screens, such as carbon black. Chlorosulfonated polyethylene is also subject to degradation on exposure to both ultra-violet light and oxygen, but incorporation of a variety of pigments into the stock including carbon black, titania, phthalocyanine blue, and chrome yellow produces an extremely weather resistant stock. Certain colorless materials which absorb ultra-violet light of the right wavelength are also effective in improving the weatherability. Unfilled stocks cured with litharge, even without ultra-violet screens, have remarkable weather resistance. Table 5 shows the changes measured after 2½ years of exposure in Wilmington, Del.

TABLE 5. WEATHER RESISTANCE OF "UNFILLED" STOCKS

Hypalon	100
Wood rosin	10
Litharge (lead oxide)	40
MBT (mercapto benzothiazole)	1
AgeRite Alba (hydroquinone monobenzyl ether)	1
Cured 60 min. at 135° C.	
Initial	
Tensile psi.	3850
% Elongation	350
After exposure in Wilmington, Del., for 34 months	
Tensile psi.	3600
% Elongation	250

The tensile strengths of elastomers decrease very rapidly with increased temperature. The effect on natural rubber is much less pronounced than it is with the synthetics, and with all elastomers the effect is minimized

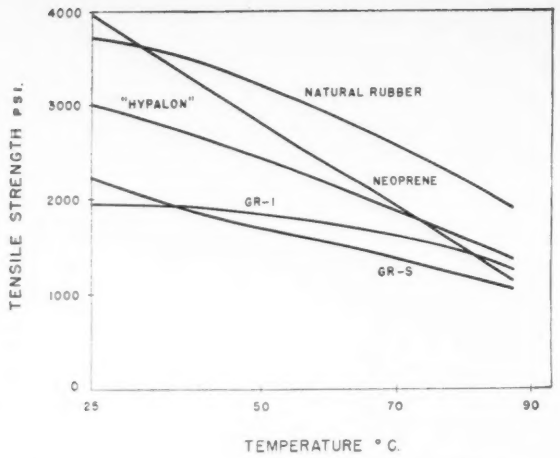

Fig. 6. Tensile Strength of Black Stocks of Various Rubbers at Elevated Temperatures

in black stocks. In the case of gum stocks only natural rubber has appreciable strength above about 50° C. Figure 4 shows how a chlorosulfonated polyethylene gum stock compares in strength with the other elastomers at elevated temperatures. In Figure 5 similar curves for light-colored compositions are shown. Several fillers, including calcium carbonate and a clay, reinforce the chlorosulfonated polyethylene stock so that it is nearly the equivalent in strength of natural rubber at 90° C. Several carbon blacks reinforce chlorosulfonated polyethylene to about the same degree as carbonate, but the black is not specific as it is with the other synthetics (Figure 6).

The reinforcing activity of calcium carbonate and other fillers is further demonstrated in laboratory abrasion measurements. Some results from measurements on the du Pont abrader are shown in Table 6. Calcium carbonate is shown to be the equivalent of black, and even the addition of titania does not impair the abrasion resistance. The outstanding resistance of chlorosulfonated polyethylene to wear, when compared with GR-S and natural rubber, is perhaps in part due to the high modulus of the material. Stiffness and hardness, which are also related to modulus, are a little higher than for most other comparably loaded elastomers.

TABLE 6. ABRASION RESISTANCE OF SEVERAL STOCKS

	M-726	M-727	M-773	M-813
Hypalon	100	100	100	100
Staybelite Resin	2.5		2.5	2.5
Wood rosin		10		
Magnesia	20			
Litharge (lead oxide)		40		
Tri-Mal (tribasic lead maleate)			33	37.5
Super Multifex (precipitated calcium carbonate)	80			
EPC Black		39.4		
"Ti-Pure" R-110 (titanium dioxide)				52.8
Tetrone A (dipentamethylene thioram tetrasulfide)	1			
MBT		3	3	2
Curing time 30 min. at 160° C.				
Tensile strength psi.	3460	3365	2575	2160
% Elongation	200	225	560	535
Abrasion resistance (cm³/h.p. hr. duPont)	24.2	35.5	49.1	55.0

Both permanent set and compression set of chlorosulfonated polyethylene vulcanizates tend to be higher than for most other elastomers. The use of basic materials such as diphenylguanidine in the curing formula increases the rate of cure and reduces the set. By this means the compression set ASTM (Method B) has been reduced from values above 50% to about 17% (Table 7).

In general, the solvent resistance of chlorosulfonated polyethylene is equivalent to that of the better synthetics. Its oil resistance is not equivalent to that of the nitrile rubbers, but it is far better than that of *Hevea*. Resistance to aqueous solutions of acids and bases, alcohol, ketones, and aliphatic hydrocarbons is good. Absorption of chlorinated solvents, aromatic hydrocarbons, and ester oils is rather high.

TABLE 7. EFFECT OF RATE OF CURE ON COMPRESSION SET

	M-911	M-912	M-913
Hypalon	100	100	100
"Staybelite" Resin	2.5	2.5	2.5
Ti-Pure R-110 (titanium dioxide)	114	114	114
"Tri-Mal" (tribasic lead maleate)	37.5	37.5	37.5
MBT	2	2	2
Diphenyl guanidine	0.0	0.25	0.5
Mooney (MS at 250° F.)			
Minutes to 100 reading	44	15.8	11
Tensile strength psi.			
10 min. at 160° C.	1860	2440	2840
20 min. at 160° C.	2110	2400	2285
30 min. at 160° C.	2265	2350	2285
60 min. at 160° C.	2110	2165	2210
Compression set (B)			
10 min. at 160° C.	81.0	41.7	33.0
20 min. at 160° C.	65.7	31.3	19.7
30 min. at 160° C.	56.3	25.6	19.3
60 min. at 160° C.	....	19.0	17.0

Summary

To summarize—a mechanism of chlorosulfonated polyethylene vulcanization has been postulated and discussed. The effects of individual components in the curing system have been considered. Several of the important properties have been discussed and compared with those of other elastomers.

Letter to the Editor

RUBBER-STICHTING
Postbox 66
Delft, Holland

11th March, 1953

THE EDITOR
INDIA RUBBER WORLD
386 Fourth Avenue
New York 16, N. Y.
U. S. A.

DEAR EDITOR,

The interesting article of C. C. Biard and J. F. Svetlik in the December, 1952, number of INDIA RUBBER WORLD, titled, "Effect of Severity of Service on the relative abrasion resistance of natural rubber, GR-S-10, and GR-S-100," appears to be of great importance for obtaining a better correlation of road wear and laboratory abrasion data.

Unfortunately, however, it does not give an unbiased impression of the properties of natural rubber. The reason for this is that the natural rubber investigated was compounded with EPC-black, while both the synthetic rubbers contained HAF black. As, according to the investigation of J. Mandel, M. N. Steel and R. D. Stiehler,[1] treads containing HAF black wear independent of type of rubber 10 to 20% longer than those containing EPC black, it does not seem fair to use the better black with the synthetic rubbers only.

A point which is lacking in the article is some descrip-

(*Continued on page 63*)

[1] *Ind. Eng. Chem.*, 43, 2901 (1951).

Methods Employed in Compounding Research—VI[1]

Ingredients for Compounding Research

I. Drogin[2]

THE following installment continues the section on ingredients for compounding research which was begun in our December, 1952, issue. Part I of this series appeared in our October, 1952, issue.

Thiokol Synthetic Rubbers

The Thiokols are organic polysulfide rubbers prepared by condensation polymerization wherein an alkaline polysulfide is reacted with a suitable dihalide. Suitable halides are: methylene dichloride, ethylene dichloride, propylene dichloride, glycerol dichlorohydrin, dichloroethyl ether, dichloroethyl formal, and triglycol dichloride. The sodium polysulfides used in these condensations can have sulfur contents ranging from sodium monosulfide to sodium tetrasulfide.

The Thiokol polymers possess good processing characteristics, high resistance to oils, low swell in organic solvents, low permeability, high tear, and they are also exceptionally resistant to ozone, sunlight, and corona discharge. The Thiokols, as shown in Table 9, are supplied as four crude rubbers, viz., Types A (119),[3] FA (120), ST (121), and PR-1 (122); three liquid polymers, Types LP-2, LP-3, and LP-8 (123); and four water dispersions (latex systems), Types MX, WD-6, MF, and WD-2 (124-125).

Thiokol Crude Rubbers

Types A and FA are, according to Fettes (126), high molecular weight polymers with unknown end-groups. Unlike natural rubber, these polysulfide elastomers do not break down to a workable plasticity on the rubber mill. It is necessary, therefore, to plasticize them chemically, using materials such as benzothiazyl disulfide or tetramethyl thiuram disulfide. Types A and FA are vulcanized with zinc oxide. Carbon blacks are needed in compounding in order to achieve the best physical properties, although a number of other reinforcing pigments can be used.

Types ST and PR-1 are polymers with thiol end-groups which require no chemical plasticization. They have their molecular weights adjusted to the millable-crude range and do not require further chemical plasticization. The polymers are, therefore, suitable for most processes without plasticization. When plasticization is required, liquid polymers LP-2 or LP-3 can be utilized to reduce the average molecular weight. Types ST and PR-1 are vulcanized with oxidizing agents. Since zinc oxide is an oxidizing agent, it can also be used for their vulcanization. Carbon blacks are the best reinforcing pigments for optimum physical properties, although others can be used.

According to Boswell and Jorczak (127), Types ST and PR-1 differ from Types A and FA in the series in that they have resistance to cold flow while retaining solvent resisting characteristics.

Thiokol Liquid Polymers

The Thiokol liquid polymers LP-2, LP-3, and LP-8 are, according to Jorczak and Fettes (128), fairly low molecular weight polymers, composed of 98% (mole) dichloroethyl formal and 2% (mole) trichloropropane.

These polymers can be converted to rubbers by the use of oxidizing agents, even at room temperatures. Any reagent which is capable of reacting with the two thiol groups can be potentially used as a curing agent. (Diisocyanates and furfural with an acidic catalyst will act as vulcanizing agent.) The vulcanized product thus consists of long linear chains held together by the small amount of trifunctionality placed in the polymer by the trichloropropane.

The highest molecular weight product, LP-2, is usable in most applications. It can be compounded, when desired, by the addition of reinforcing fillers and pigments on a three-roll paint mill, colloid mill, ball mill, or internal mixer.

The medium molecular weight product, LP-3, is used as an impregnant or where very fluid formulations are required. As a larger amount of vulcanizing agent is needed, the cure is more difficult to control because of the exothermic character of the oxidation reaction. The p-quinone dioxime-diphenylguanidine combination or a cobalt drier generally is used.

The polymers in the low molecular weight form are soluble in a wide variety of solvents. The lower the molecular weight, the higher the amount of solvent miscible with the polymer. The solvents are: benzene, toluene, dioxane, cyclohexanone, furfural, ethylene dichloride, phenol, dibutyl phthalate, tricresyl phosphate. The following are limited solvents: xylene, acetone, methyl, ethyl ketone, ethyl acetate, butyl acetate, carbon tetrachloride, 2-nitropropane. These limited solvents are only partially compatible with the liquid polymers. Beyond the limits of solubility, two layers are formed. Compatibility varies with the particular solvent and with the molecular weight of the liquid polymer. The non-solvents are aliphatic hydrocarbons, methanol, ethanol, butanol.

The swelling of Thiokols in various chemicals and solvents is described by Panek and Wallover (125).

Thiokol Water Dispersions (Latex Systems)

The Thiokol water dispersions (latex systems) (124-125), MX, WD-6, MF, and WD-2, are dispersions of polysulfide polymers which have been developed for

[1] Based on a paper presented before the Ontario Rubber Section, C. I. C., Toronto, Ont., Canada, Mar. 11, 1952; The Los Angeles Rubber Group, Inc., Los Angeles, Calif., Apr. 1, 1952; and the Northern California Rubber Group, San Francisco, Calif., Apr. 10, 1952.

[2] Director of research, United Carbon Co., Charleston, W. Va.

[3] Numbers in parentheses refer to Bibliography items at the end of this installment.

TABLE 9. IDENTIFICATION OF THIOKOL SYNTHETIC RUBBER*

A. Thiokol Crude Rubber

Polymer	Type A	Type FA	Type ST	Type PR-1
Description	Amber-colored solid	Tough resilient amber-colored solid.	Amber-colored solid polysulfide type rubber. After vulcanization it is no longer plastic.	An improved Thiokol FA cured by a different mechanism. Raw stock is more scorchy and possesses poorer bin aging life than do Thiokol FA compounds.
Composition	Organic polysulfide rubber prepared from alkaline polysulfide with ethylene dichloride.	Organic polysulfide rubber prepared from alkaline polysulfide with ethylene dichloride dichloroethyl formal.	Organic polysulfide rubber prepared from alkaline polysulfide with dichloroethyl formal.	Same as FA.
Cross-linked	No	No	Yes	Yes
Specific gravity	1.60	1.33	1.25	1.33
Properties	Non-toxic rubber-like solid with sulfurous odor.	Non-toxic rubber-like solid with mild sulfurous odor.	Same as FA.	Same as FA.
Solvent resistance	Extremely resistant to solvents and water.	Practically unaffected by motor gasoline (including benzol blends) fuel oil, kerosene, lubricating oils, and other petroleum hydrocarbons; can be satisfactorily used in contact with benzol, toluol, and xylol; ketones and esters, as used in paints, varnishes, and inks, have little effect; not affected seriously by carbon tetrachloride; not affected by dilute acids and alkalies; destroyed by strong acids.	Oil resistant. Affected to a slight degree by loading and state of cure. Practically unaffected by motor gasoline, kerosene, fuel oil, lubricating oil, and other petroleum hydrocarbons; alcohols, glycols, and other hydroxy solvents do not seriously deteriorate ST compounds; not seriously affected by dilute alkalies; decomposed by strong acids.	Possesses better solvent resistance in the lacquer thinner solvents than does Thiokol ST.
Mooney plasticity range	.....	.....	25–35	15–25
Bin stability	Stable for long periods of time.	Stable for long periods of time.	Certain ST stocks tend to increase in plasticity after a short period of storage; certain compounds have shown evidence of vulcanizing in storage.	One week. While the stock may partially set-up in storage, it can still be molded satisfactorily.
Accelerators of vulcanization	Zinc oxide.	Zinc oxide is the only material required for vulcanization. Where faster curing stocks are required sulfur can be used.	Combination of zinc oxide and GMF (p-quinone dioxime).	Zinc oxide. Regular rubber accelerators will have a deleterious effect on compression set resistance of the vulcanizate.
Breakdown	TMTDS† and DPG‡ used as chemical plasticizers.	Same as A.	Mill breakdown not possible. Plasticize with LP-3.	Same as ST.
Reinforcing pigments	.....	It must be compounded and vulcanized to develop its maximum rubber-like properties. Semi-reinforcing (SRF) and soft carbon blacks (MT and FT).	Only carbon black pigments can be recommended as reinforcing pigments. SRF blacks are preferred for ease of processing for normal loading of 60–70 parts. FF black can be used for better physical properties. Channel blacks are difficult to disperse and are not generally recommended.	Carbon blacks such as fine furnace (FF), high modulus (HMF), semi-reinforcing (SRF), fine thermal (FT), and medium thermal (MT) are recommended. FF blacks provide highest tensile; HMF blacks yield high hardness stocks; FT and MT are useful for soft stocks and heavily loaded harder stocks. For general use the SRF blacks are preferred because of their ease of processing and the good physical properties imparted to the cured stocks.
Swell	Very low swell in the more active compounds such as benzol, chlorinated solvents.	Low swell in aromatic blended fuels, aliphatic hydrocarbons, oils, greases, lacquer thinners, esters, ketones, alcohols. Resistant to mild acids. Strong acids cause deterioration.	Volume swell slightly greater than that of FA, depending on the type of solvent used. Swells to a relatively high degree in straight aromatic solvents; strong solvents such as ketone, esters, and chlorinated solvents swell ST to a greater extent than they do other Thiokol synthetic rubbers.	Low swell in esters, ketones, aromatic blended fuels, oils, greases and lacquer thinners. Dilute acids cause slight softening while concentrated acids cause deterioration.
Resistance to ozone, sunlight and ultra-violet light	Excellent for black stocks.	Stocks compounded with carbon black will not check or craze when exposed to sunlight or ultra-violet light; exceptional resistance to ozone.	Stocks compounded with carbon black will not check or craze when exposed to sunlight or to ultra-violet light; exceptional resistance to ozone.	Excellent.
Permeability to gasoline, aromatic blended fuels, and other volatile liquids or solvents	Very low.	Very low.	Low.	Very low.
Useful temperature range	Narrow. It extends from 0 to around 150° F., depending on the compound and the conditions under which it is used.	Can be used at temperatures up to 180° F. for long periods of time. Exposure at temperatures above 250° F. will cause gradual hardening.	Can be used satisfactorily at temperature of 200° F. and above. The polymer does not melt or soften materially at elevated temperatures.	−60 to +212° F. Low-temperature range of stocks containing no plasticizer is −45° F. Serviceable up to temperatures of 300° F. in intermittent cycles. Cured polymer does not melt or soften at elevated temperatures. Above 212° F. after a considerable period of time it loses elongation and tensile owing largely to overcure. Does not have the extreme low temperature resistance of Thiokol ST.

*Thiokol Corp., Trenton 7, N. J.
†Tetra methyl thiuram disulfide.
‡Diphenylguanidine.

(Table continued on next page)

Table 9-*A* (*Continued*)

Polymer	Type A	Type FA	Type ST	Type PR-1
Cold flow	Exhibits cold flow when under compression for long periods at ambient temperature. Flow more rapid at elevated temperatures.	Shows remarkably fast and complete comeback from momentary distortion. When compressed for long periods of time, especially at elevated temperatures, exhibits plastic flow.	Considerable resistance and better than that of a number of other synthetics.	After vulcanization, possesses considerable resistance to cold flow.
Brittleness	Brittle at about −10° F.	Brittle at about −45° F.	Brittle at about −65° F.	Same as FA.
Uses	As a plasticizer for sulfur. It is a valuable agent for use in sulfur cements. Used as a rubber where extreme resistance to solvents is desired.	Used where low swell stocks are desired; particularly useful for paint spray, oil and gasoline hose.	Better suited for manufacture of molded goods than either A or FA. For compounds that must possess good low-temperature resistance, especially where extractable plasticizers are undesirable. Good solvent resistance, low swell in solvents; freedom from shrinkage in low swelling oils and solvents and resistance to deterioration by sunlight and ozone.	For the manufacture of molded goods difficult to process from Thiokol FA.
Compression set characteristics	Considerable compression set at elevated temperatures.	Some compression set at elevated temperatures.	After vulcanization, has good resistance to compression set at room temperature and slightly elevated temperatures.	Similar to ST.
Discoloration	Can be compounded so as not to discolor white solvents or change shade of colored solvents.			
Permeability to gases	Very low for fixed gases, organic liquids, and gases and water.	Very low permeability to fixed gases, including CO_2, gasoline, and other volatile solvents.	Very low permeability to gasoline, including benzol blends and other volatile liquids and solvents.	Same as FA.
Natural aging	Excellent.	No appreciable change.	Slight increase in hardness with age and a decrease in elongation, tensile strength remains constant; no tendency for the stock to revert or to become brittle; withstands oxygen bomb aging with practically no change in physical properties.	Same as ST.
Low-temperature flexibility	Good at −10° F.	Can be compounded without plasticizer so that it will not crack when bent double at temperatures as low as −50° F.	Better than that of the other oilproof rubbers containing no low-temperatures plasticizers or after extraction in non-swelling oils or solvents. Vulcanizates are OK at −65° F. and can be bent double without breaking.	Same as ST to −45°
Softeners	Tuads and DPG.	Plasticize with Altax.§	Plasticize with LP-3 (a Thiokol liquid polymer of the same composition as ST.) Use from 0–20 parts. During vulcanization the LP-3 undergoes a reaction that converts it into vulcanized ST. Altax is unsatisfactory.	Same as ST.
Stearic acid	Same as FA.	Stearic acid performs two-fold function in FA mix. It keeps the stock from sticking to the mill rolls during mixing and to molds during cure. It also aids in dispersion of pigment. 0.50% is recommended.	Stearic acid has been found to inhibit bin setup. It is recommended that stocks compounded with carbon black contain from 2–3% stearic on the ST.	Same as ST.
Non-black pigments	Same as FA.	Not all the non-black fillers that can be used with rubber can be satisfactorily used with FA. Those that can be used do not reinforce FA to the same extent as SRF blacks.	Gives poor physical properties.	Gives poor physical properties.
Processing	Difficult to process. It gives off considerable gas when hot.	Marked improvements over other types of Thiokol rubbers, notably in the absence of lachrymating gases during processing, less odor, and better processing qualities.	Easy processing, but tendency to scorch.	Same as ST.
Plasticity range	Can be processed over wide plasticity range.	Close control of plasticity required for best processing.	ST compounds have a much wider plasticity range than that of FA.	Same as ST.
Curing range	.....	.....	Flat curing range and does not readily overcure.	.....
Compatibility	With all rubbers except butyl.	Same as A.	With all rubber except butyl. Other rubbers should be cured with quinona dioxime to prevent curing ST phase.	Same as ST.

B. Thiokol Liquid Polymers

These polymers (128) are composed of 98% (mole) dichloroethyl formal and 2% (mole) trichloropropane. The vulcanized product thus consists of long linear chains held together by the small amount of trifunctionality placed in the polymer by the trichloropropane. The polymers in the low molecular weight form are soluble in a wide variety of solvents. The lower the molecular weight the higher the amount of solvent miscible with the polymer.

Polymer	Type LP-2	Type LP-3	Type LP-8
Molecular weight (average)	4000	1000	300
Viscosity (poise)	450	10	0.5
pH	6 to 8	5 to 6	5 to 6
Specific gravity (20/20)	1.27	1.27	1.23
Description	Non-toxic, viscous amber-colored liquid with slight mercaptan odor.	Non-toxic, viscous amber-colored liquid with slight mercaptan odor. Similar to to LP-2, but has lower molecular weight.	Same as LP-2.

§Benzo-thiazyl disulfide.

(*Table concluded on next page*)

Table 9-B (*Continued*)

Polymer	Type LP-2	Type LP-3	Type LP-8
Compounding	Compounded with fillers, reinforcers, and coloring materials on a three-roll paint mill or kneading machine.	Not normally compounded. Used as additive for phenolic, resorcinol epoxy resins as flexiblizing agent and for impregnation.	Same as LP-3.
Vulcanizing agent	Lead peroxide.	.....	.....
Retarder	Stearic acid	.....	.....
Vulcanizate	Oil-resistant type. A liquid rubber which can be vulcanized to give products possessing excellent resistance to oils, solvents, ozone, sunlight, and low temperatures.	.....	.....
Cures	Without shrinkage.	.....	.....
Uses	For caulking compounds, casting compounds, impregnants, sealing compounds and protective coatings; for casting and impregnation compounds; filling voids in leather, wood, felt, fabric, transite and porous castings, carbon sealing and sealing integral fuel tanks in aircraft; in leather impregnation and in preparation of flexible molds; in the preservation of ships.	Plasticizer and softener. Properties are similar to those of LP-2, but is a better impregnant because of its lower viscosity; plugs in electrical cables.	Has been converted in materials such as leather and transite by a cobalt drier solution followed by impregnation with LP-8.
Reinforcing fillers: black	Fillers strengthen and reduce cost of compounds; most commonly used fillers are MT, SRF, and FF blacks.	.....	.....
White fillers	Zinc sulfide, lithopone, titanium dioxide, zinc oxide, calcium carbonate, aluminum oxide.	.....	.....
Electrical Properties			
Volume-resistivity (ohms/cm.)	5×10^{15}	.....	.....
Power factor	0.0410	.....	.....
Dielectric constant	7.50	.....	.....

C. Thiokol Water Dispersions (Latex Systems)

Polymer	Type MX	Type WD-6	Type MF	Type WD-2
Composition	Ethylene dichloride; propylene dichloride.	Same as MX.	Ethylene dichloride; dichloroethyl formal.	Dichlorethyl formal; trichloropropane.
% Solids in water dispersion	50	50	50	50
Specific gravity	1.4	1.4	1.45	1.3
Particle size (Microns)	2-6	2-6	4-8	8-15
Odor	Disagreeable.	Disagreeable.	Unpleasant.	None.
Solvent resistance	Excellent.	Excellent.	Excellent.	Excellent.
Water resistance	Good.	Good	Good	Fair.
Low-temperature flexibility	−20° F.	−20° F.	−40° F.	−65° F.
To film	Requires softener.	No softener required.	Same as MX.	Same as MX.
Softening treatments	(a) Add 0.3–0.6% TMTDS based on water dispersion solids and heat for one hour at 180° F. with continuous stirring.	Will give a relatively tough film without the addition of a softening agent.	(a) Add 0.75–1% TMTDS based on water dispersion solids and heat for one hour at 180° F. with continuous stirring.	(a) Add 1.25–1.5% TMTDS based on water dispersion solids and heat for one hour at 180° F. with continuous stirring.
	(b) Heat water dispersion of 50% solids to 160° F.; allow to cool to 140° F., and stir in the equivalent of 2 cc. ammonium hydrosulfide solution (8% H_2S assay) per 100 grams dry weight of dispersion.		Same as (b) for MX.	(b) Heat water dispersion of 50% solids to 160° F.; allow to cool to 140° F., and stir in the equivalent of 4 cc. ammonium hydrosulfide solution (8% H_2S assay) per 100 grams dry weight of dispersion.
			(c) When softening is required where heat is not available or not desired, use 1–2% of Setsit #1 or 3–4% of Setsit #5(¶) based on dispersion solids.	(c) When softening is required where heat is not available or not desired, use 2–3% of Setsit #1 or 5–6% of Setsit #5 based on dispersion solids.
Aging characteristics	Good; film toughens gradually over a period of about three months with some loss in elasticity.	Good; film toughens slightly over a period of about three months.	Good; films maintain good elasticity and strength over prolonged periods.	Same as MF.
Applications	Sprayed or brushed; spraying consistency, about 35% solids; brushing consistency, about 40% solids.			
Recommended uses	Where the ultimate in solvent resistance is required and extreme elasticity and low-temperature flexibility are not important. Used very successfully as a coating for concrete storage tanks.	Where the ultimate in solvent resistance is required and extreme elasticity and low-temperature flexibility are not important.	Excellent protective coating material for many applications.	Where lack of odor is important or where exceptional flexibility at very low temperatures is a primary requisite.

(¶)From R. T. Vanderbilt Co.

special applications in the protective coating field. They are not intended as substitutes for natural rubber latex, nor are they similar in handling and use to the various synthetic rubber latices. Type MX differs from WD-6 only in containing less propylene dichloride, which has a softening effect upon the copolymer; WD-6 contains enough propylene dichloride to deposit a continuous film on drying. Thiokol water dispersions are manufactured containing approximately 50% solids. The particle sizes are from 2-15 microns, and specific gravities are from 1.3 to 1.45, depending upon type. Owing to the relatively large particle size and high specific gravities, the particles tend to settle out of suspension rapidly, but may be readily redispersed with agitation. Compared to natural rubber latex, Thiokol water dispersions are exceptionally stable to chemical and physical action. As fur-

nished, they, with the exception of WD-6, cannot be used as finished coating materials. A softening treatment is necessary to form a continuous film which is free from cracking upon drying. A typical softening treatment consists of the addition of a small amount (0.5-1.0%) of TMTDS (tetramethyl thiuram disulfide) and heating for one hour at 180° F. with stirring. Forty per cent. solids is suitable for brushing, and 35% for spraying.

When properly compounded and applied, a Thiokol water dispersion film will have excellent resistance to oils and solvents (except the chlorinated type); good resistance to water; good adhesion to clean metal, wood, and concrete surfaces; excellent flexibility at low temperatures; good resistance to aging and to dilute acids and alkalies. They are not recommended for applications where temperatures are above 180° F.

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(To be continued)

Continuous Emulsion Polymerization

(Continued from page 53)

higher butadiene content, superior to those of X-603.

In general, the 75/25 butadiene/styrene copolymer made continuously at 122° F. with the short reaction time, when mill mixed, processed with slightly more difficulty and exhibited better freeze resistance than did standard GR-S (X-603). The differences in properties of XP-264 and X-603 may be due to the difference in combined styrene contents.

The method of preforming an emulsion in a circulating system by means of a centrifugal pump, followed by polymerization in tubes or pipes in essentially linear flow, has been proved practical for the preparation of GR-S at the "hot rubber" polymerization temperature of 122° F.

Summary

GR-S comparable to standard "hot rubber" has been prepared at 122° F. with a reaction time of 15-20 minutes in pilot-plant quantities in a continuous process polymerizer consisting of 382 feet of ⅝-inch tubing with a volumetric capacity of 4.9 gallons. The flow was essentially of the stream-line type; turbulent flow was shown to be unnecessary.

Cold rubber (GR-S polymerized at 41° F. to 60% conversion) can be prepared in this equipment, but not without using higher-than-normal proportions of water and soap.

The results indicate that probably installation cost economies can be achieved in the reactor area of new GR-S plants for the manufacture of hot rubber. The monomer storage, recovery, coagulation, drying, shipping, and other areas should be unaffected. The process offers the possibility of lowering repair costs in existing hot rubber plants by permitting reactors to be replaced at lower cost after they wear out.

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Letter to the Editor

(Continued from page 58)

tion of the degree of severity of the road tests. On the one hand it is known from the investigation of Mandel *et al.* that the wear behavior of natural rubber treads and of cold rubber treads, compounded with the same black, is fairly similar under normal road test conditions. On the other hand natural rubber is generally preferred for heavy-duty tires because of its lower heat build-up. It would therefore certainly be of great interest to know under what kind of conditions such big differences in favor of the synthetics have been found.

Sincerely yours,
RUBBER-STICHTING
Research Department
by
Dr. G. J. van Amerongen

Rubber Men on Honors List

The British rubber industry was not overlooked in the distribution of the New Year Honors. Chief among those so distinguished was Sir Clive Baillieu, chairman of Dunlop Rubber Co., Ltd., created a baron in recognition of his public services. Knighthoods were received by Walter Fletcher, chairman of Hecht, Levis & Kahn; and by Major H. R. Watling, until recently director of the British Cycle & Motor Cycle Manufacturers' Union. Both gentlemen have been awarded the C.B.E., the former for political and public services, and the latter for his services to the two industries he represented.

Editorials

A Good "Industry Pattern" for Synthetic Plant Disposal Already Exists

NOW that the Reconstruction Finance Corp. has presented its program for the disposal of the government-owned synthetic rubber plants to private industry, and general approval of the RFC plan has been evidenced by those members of Congress almost certain to assume a major role in shaping the final government policy and program for disposal, it should be possible to get down to cases and make some more or less specific suggestions. A considerable degree of harmony seems to exist between the views of these Congressional leaders, the President, the RFC, and the rubber industry, on the need of disposal and the broad, general principles by which it may be brought about. On the other hand, there seems to be undue preoccupation by some members of Congress and the RFC with the importance of creating what is called "an industry pattern that, by avoiding situations of dominance and by assuring a supply of rubber to those users who do not purchase facilities, will permit the free operation of competitive forces."

An "industry pattern" of GR-S *consumption* is revealed in the RFC report and should be a good basis for a satisfactory "industry pattern" of GR-S copolymer *production* by private industry, without giving any company or group of companies a dominant position. The problem is to provide sources of supply of GR-S for the several hundred non-tire producing companies from GR-S plants owned and operated by companies not themselves consumers of this synthetic rubber.

The RFC report states that in 1952 the Corporation had about 700 synthetic rubber customers, and, of these, the 20 largest tire companies accounted for more than 77% of the sales. The remaining 680 companies accounted for 23%, and of these, 20 absorbed more than 5%. Out of 700 customers, therefore, 40 accounted for 82%, and 660 for only 18% of synthetic rubber sales. In addition, the Big Four rubber companies alone accounted for 63% of the total sales.

The report is dealing with sales of GR-S plus butyl rubber, but for this discussion GR-S sales only will be considered, since disposal of butyl rubber plants is a somewhat different and possibly simpler problem.

It might as well be assumed from the beginning that any disposal of GR-S copolymer plants will have to provide an opportunity for each one of the Big Four companies to purchase at least 100,000 tons a year capacity, or none of these companies should be permitted to acquire any facilities. About 650,000 long tons of GR-S were consumed in 1952, and 63% of this figure is about 400,000 tons, or about 100,000 may be assumed as used by each of the Big Four. The contributions of these companies along with many others during World War II and thereafter would seem to entitle the Big Four to a fair chance to obtain at least 100,000 tons a year GR-S capacity each. Butadiene facilities could be assured by joint ownership with petroleum company operators of facilities now adjacent to certain GR-S plants.

The remaining 16 tire companies used 14% of the GR-S sold in 1952, or about 90,000 long tons. Two GR-S facilities, one at Baytown, Tex., of 44,000 tons' annual capacity, operated by General Tire & Rubber Co. with 5% participation by McCreary Tire & Rubber Co., and the other at Baton Rouge, La., of 49,000 tons' capacity, operated by Copolymer Corp., a group of eight other tire companies, could satisfy the present requirements of these 16 companies, under private industry ownership and operation.

If the present operators of the above-mentioned GR-S facilities bought these plants, would the other six tire companies in this group be satisfied to buy their synthetic rubber from their competitors in the tire manufacturing field? There is a good chance that as a matter of established business practice, they would not. These six tire companies would therefore be made-to-order customers for petroleum or chemical company purchasers of GR-S plants.

The needs of the 680 other rubber goods companies which consumed 23%, or about 150,000 tons of GR-S, in 1952, should also be taken care of, preferably by GR-S producers not also in the rubber goods manufacturing field. A GR-S copolymer plant at Borger, Tex., of 66,000 tons' capacity is operated at present by Phillips Chemical Co., which also operates an adjacent butadiene plant. Another GR-S copolymer plant in Los Angeles, Calif., of 89,000 tons' capacity is operated by Midland Rubber Corp., a joint venture of Minnesota Mining & Mfg. Co. and Pacific Rubber Co. These two facilities could provide enough GR-S for the 680 other rubber goods companies, but this limited participation of the non-rubber companies in the private industry GR-S production pattern might be questioned by the Congress.

With GR-S consumption expected to increase by 200,000 tons a year in the near future, that amount of production capacity would still be available for purchase by interested petroleum and chemical companies and would result in a better balance between rubber and petroleum and chemical companies.

It may be concluded, therefore, that the disposal of the GR-S plants could follow the pattern already established by GR-S consumption and plant operation without giving any company a dominant position.

R. G. Seaman

Coloring of Vinyl Dry Blend Compound

Richard L. Lynch[1]

A MAJOR step in the rapid and constant advance of the plastics industry is the new dry blend technique of compounding vinyl material for extrusion. There are a number of good reasons for this tremendous swing to the dry blend process:[2]

(1) Elimination of conventional heavy and expensive compounding equipment.
(2) Low conversion costs.
(3) Minimization of heat history in the production of extrusions.
(4) Economy and efficiency in materials handling.
(5) Increased extrusion rates because a first fusion requires a lower temperature and less time than a second fusion.
(6) Uniformity of finished product.

These advantages can be summarized as lower cost of compound manufacture, and higher quality of product. There is no need of expensive Banbury mixing or two-roll milling; quality is higher because the resin is subjected to high temperatures only during the extrusion operation. These factors contribute to better color retention and more uniform physical and electrical properties in the finished product since there is less heat degradation.

Manufacturers of vinyl resins are alert to this swing to dry blend and are beginning to produce resins in improved particle form that will more readily absorb the plasticizer in simple ribbon blenders, mullers, or other dry mixers.

Manufacturers of extrusion equipment are likewise modifying their designs to accommodate vinyl dry blend. Since the extruder, in this case, has the additional function of fluxing the compound as well as extruding the mass, more mechanical work must be done on the compound between hopper and die. One method of accomplishing this is to increase the length of the extruder barrel and use a longer screw; some extruders have already modified their own equipment in this manner.

Other methods of increasing extruder efficiency involve redesigning the worm, breaker plate, and die to give maximum fluxing and maintain a high compression ratio. The new multiple-screw extruders, however, would seem to be the most logical advance in specially designed machines for dry blend. It should be emphasized that unless the compound receives complete fluxing within the dry blend extruder, the advantages of the process are sacrificed to poor physical properties in the extruded product.

Limitations of Dry Blend Process

There are some limitations to be considered in formulating for dry blend, particularly for the very soft and very hard compounds. The maximum amount of plasticizer that can be absorbed by present resin powder mix methods, and still have a free-flowing, sandy mixture, is usually 65-70 parts per 100 parts resin. This quantity is not enough for some very soft formulations. More plasticizer can be added if it is "dried up" in the blender with more filler, but this procedure is not always desirable. While the ester-type plasticizers, such as DOP and TCP, are most readily absorbed, many of the useful polymeric-type plasticizers needed for specific requirements, such a minimum migration or resistance to high or low temperatures, do not work too well in current powder mix methods.

With very hard extrusion formulations the reduced amount of plasticizer cannot, as yet, be sufficiently and uniformly worked into the hard resin to give a stock that will extrude as smoothly as granular premilled materials. However, the majority of vinyl compounds, and certainly the large-volume stocks such as wire and cable compounds, can be handled easily and efficiently by the dry blend process.

Pigment Requirements for Dry Blend

Colorants for vinyls have been and still are the subject of much intensive technical study by both the pigment and the resin manufacturers. This study is complicated by the fact that color stability is a direct function of the heat and light stabilizers employed in the formulation. The chemical disturbances set in motion by heat and light in a vinyl compound can cause a pigment to fade, change color, or decompose; yet this same pigment may be perfectly heat- and light-fast when used in a nitrocellulose lacquer formulation.

Thus, the extruder who has been purchasing granular compound and now assumes the responsibility of producing his own extruding compound may find himself at a disadvantage when trying to formulate a specific compound without the aid of a chemist. In such cases the extruder-processor will be wise to work under the supervision of his vinyl resin supplier who can draw on the technical resources of his laboratory and has experience with a wide variety of materials.

In addition to special chemical considerations for vinyl pigments, the following colorant characteristics are also very important:

(1) Brightness and purity of color.

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[2] "Dry Blending Monsanto Opalon 300 in the Manufacture of Extruded Products," Monsanto Chemical Co., Springfield, Mass. Production Information Bulletin No. 79. (1952).

(2) Uniformity of extruded color.
(3) Maximum tinting strength per pound of pigment.
(4) No pigment agglomerates to cause streaks and specks.
(5) Minimum reduction in dielectric strength when used in wire insulation stocks.
(6) Freedom from occluded air and moisture (a source of pinholes in extruded products).

All of these colorant properties in a dry blend compound are well within the control of the processor himself, and are primarily concerned with good pigment dispersion and proper coloring of the stock. In essence, then, the problem of coloring dry blend resolves itself into two parts: (1) choosing the right pigments or combination of pigments and stabilizers; and (2) getting the full color value out of that pigment by suitable dispersion and incorporation into the extrusion stock.

Selection of Pigments

By staying within the confines of a relatively small group of pigments, as carefully worked out by vinyl experts, the extruder-processor can avoid many serious and expensive headaches. The following pigments work well in a great number of compounds, but the final selection and formulation of pigments should be checked in the extruded compound, and again in the finished product.

WHITE. Most stabilizers, extenders, and fillers are sufficiently opaque to provide a natural white stock. Titanium dioxide will add brilliance and hiding powder, is inert chemically, has good electrical properties, and is not too difficult to disperse.

RED. Cadmium reds have been the most widely used reds in calendered vinyl stocks and have excellent stability toward heat, light, and alkalies, although sensitive to acids. They are not very bright and clean, however, when diluted with extenders and stabilizers in an extrusion compound. More brilliance can be had with certain organic pigments such as BON reds (beta oxy naphthoic acid), lithol rubine, and pigment scarlet, but these colorants are not quite so light-fast as the cadmium reds and should be used with stabilizers that are not too highly alkaline. Also, reds generally give lower dielectric properties than the other colors.

YELLOW. The lead chromate pigments are excellent in vinyl compounds because of their strength, brilliance, low cost, and ease of dispersion. As lead compounds, they also contribute some stabilizing action to the formulation. Better light-fastness in the very light or greenish primrose shades can be had with strontium chromate. At temperatures over 400° F. the chrome yellows tend to darken and will also darken rapidly in the presence of sulfur or sulfur-containing pigments. The chrome yellows are also sensitive to alkalies. When cadmium yellow (essentially cadmium sulfide) is used, the compound should be well stabilized toward heat to avoid sulfide odors which can develop from the slightest acidic decomposition of the resin. With this precaution, cadmium yellows are excellent in vinyls.

ORANGE. Molybdate orange, an excellent vinyl pigment, is similar chemically to medium chrome yellow. Chrome orange is considerably weaker and less brilliant than molybdate orange, particularly in a compound containing fillers or extender pigments.

BLUE. Phthalocyanine blue is nearly a perfect pigment from the standpoints of strength, brilliance, light-fastness, and chemical and heat stability. This blue is expensive, however, and is not easily dispersed. Iron blue is also a good pigment at a much lower cost and has better dielectric properties than phthalocyanine blue. As an iron salt, however, it will readily catalyze the breakdown of vinyl resin under heat and light unless carefully stabilized. Cadmium stearate is one of the preferred heat stabilizers for use with iron blue. Since iron blue is extremely sensitive to alkalies, highly alkaline stabilizers must be avoided.

Indanthrene blue is used in certain special vinyl compounds and is an excellent pigment, but expensive. Ultramarine blue is seldom used because of its poor resistance to the slightest breakdown of the vinyl resin, with resultant chemical fading and sulfide odor. This hazard is reduced in dry blend because of reduced heat history; so we may anticipate greater use of ultramarine blue in vinyl extrusion stocks.

GREEN. Phthalocyanine green, like phthalocyanine blue, is excellent in vinyls, but even more expensive than the blue. Chrome greens extrude satisfactorily if the same stabilizing precautions are taken as for iron blue. This condition exists because chrome greens are coprecipitates of chrome yellow and iron blue. Chromium oxide pigment is very stable toward heat, light, and chemicals, but is not used because of its light, grayish color and weak strength. Greens can be made by blending phthalocyanine blue with yellow, but are not practical in dry blend because color distribution and uniformity are difficult to achieve properly at the very low pigment concentration used.

MAROON. The BON's are the most commonly used maroons in vinyls and are quite satisfactory for this purpose. They are chemically similar to the BON reds, and the same precautions should be taken to avoid too alkaline stabilizers. Like the reds, the BON's are not easily dispersed.

IRON OXIDES. The yellow, red, and brown iron oxide pigments are chemically stable, very light-fast, and quite inexpensive, but are comparatively weak colors and have been considered hazardous in vinyls because of their iron catalytic effect on the resin at high temperatures. This catalytic degradation is actually caused by ferric chloride resulting from the reaction between the iron compound and hydrogen chloride liberated from the resin at high temperatures. The iron oxides have not proved troublesome in most compounds at temperatures *under 375° F.* This temperature is somewhat low for dry blend extruding, and in any event the iron oxides should only be used in very carefully heat stabilized compounds.

BLACK. Carbon blacks are standard pigments for this purpose, but are difficult to disperse. All carbon blacks degrade the dielectric strength of an insulating compound, particularly when poorly dispersed.

Incorporation of Pigments

Color pigments can be incorporated into the compound along with the other dry ingredients in the blender or mixer, or can be added subsequently to the "natural" dry blend by tumbling in separate equipment. For some end-uses the pigment, like the extenders and the stabilizers, can be incorporated "raw" or without special pretreatment. In most cases, however, it is either necessary or advantageous to use predispersed pigment in the dry blend compound.

In "as supplied" form, most pigments have been either finely ground or precipitated in small particle size form from chemical solutions. In the dry state, however, each pigment particle is surrounded by a film of air and moisture and has joined other particles to form clusters commonly known as "agglomerates." Fundamentally, therefore, two things must be accomplished when dispersing pigments either for coloring extruded plastic or coloring a decorative enamel coating: (1) the agglomerates must be broken up into either ultimate particles or at least much smaller agglomerates; and (2) the pig-

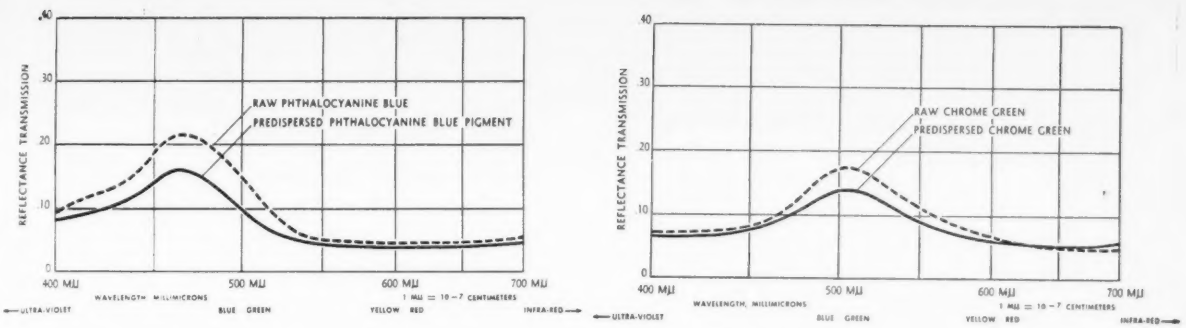


Fig. 1. The Above Curves Illustrate the Color Development in an Extruded White Dry Blend Compound Pigmented with Identical Quantities of Predispersed Pigment (R-B-H Plastic Powders) and Raw Pigment. The Deeper Colors Resulting from Predispersed Pigment Give Lower Spectrophotometric Reflectance

ment must be wet (i.e., the film of air and moisture on each particle replaced with a film of vehicle). These requirements are accomplished primarily by the action of mechanical forces; a crushing and shearing action on the pigment clusters in a very viscous vehicle to reduce particle size and wet the pigment.

When using raw pigments in a dry blend formulation, the processor is restricted to those pigments that are easiest to disperse. Titanium dioxide, for example, is comparatively easy to wet, and its agglomerates are not too hard to reduce. If this pigment is added together with the other dry ingredients to the blender after the plasticizers have been completely absorbed by the heated resin, and the mixer run for an additional 30 or 60 minutes to help reduce the pigment agglomerates, the subsequent mechanical and shearing action that takes place within the extruder is often sufficient to do a fairly satisfactory job of dispersing the pigment.

Carbon black has an extremely fine particle size, and even its agglomerates will not always show up badly in an extruded black profile shape. Where a small amount of raw carbon black is needed in a dry blend to tint another pigment, however, any black agglomerates that slip through are liable to show up as streaks or comets in the extrusion. Furthermore raw carbon black is capable of carrying appreciable quantities of occluded moisture or gases into the compound. Unless this moisture or gas can be driven off by heat (over 212° F.) during the dry mixing, they can be a troublesome source of pinholing in the extruded profile.

Other pigments, such as blues, greens, and reds, have hard agglomerates which cannot be completely reduced by the mechanical forces in the extruder. In addition, some of the better stabilizers, such as basic white lead silicate, may cause trouble in this manner by giving unreduced agglomerates that clog the extruder screens.

The only suitable means of getting well-dispersed pigment into a dry blend, therefore, involves some method of prior dispersion. The advantages of such dispersion are quite worthwhile, since reduced pigment agglomerates give more color particles per pound of pigment. In addition, the extruded color will be more dependable and uniform from batch to batch. In insulating compounds the pigment clusters also reduce the dielectric strength. Noticeable higher gloss in the extruded product is another advantage of good pigment dispersion.

Predispersed Pigment

The processor can predisperse his own pigment for dry blends by any of the following three methods:

(1) With a three-roll ink mill the pigment can be dispersed in a part of the plasticizer. The resultant paste is then dried up by mixing with sufficient powdered resin to give a sandy, free-flowing color concentrate which can later be tumbled in separate equipment with natural or clear dry blend.

(2) With a two-roll mill the pigment can be masterbatched with vinyl resin and a little of the plasticizer. This concentrate is then chipped and tumbled in small quantities with the natural dry blend.

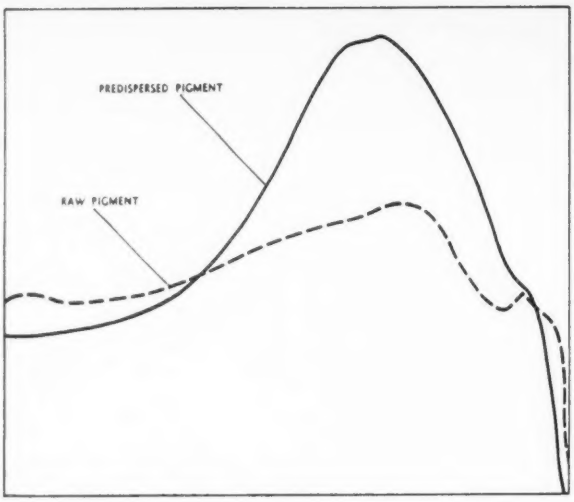
(3) Some processors attempt to "masterbatch" pigment in their dry blending equipment by adding a large quantity of raw pigment to the completed dry blend and then continue rapid mixing for an hour or more to produce a color concentrate with reduced pigment agglomerates. Except for perhaps a few of the softer, more easily dispersed pigments, it is doubtful that this method has much to offer by way of predispersion.

Only the first of these three methods is to be recommended. The second method gives excellent pigment dispersion, but the resulting masterbatch is too tough to be pulverized fine enough for good distribution in dry blend. The color chips are so large that when 1% by weight is tumbled with dry blend, the chips are too scattered to give even coloring in the extruded product. This disadvantage can be overcome by using an excessive amount of color chips (3-4%), but this approach can hardly be considered economical.

A New Commercial Pigment Dispersion for Dry Blend

Since the amount of color pigment required in a compound is so extremely low (0.05-2%), there are few vinyl extruders in the country today who have sufficient volume of color requirement to make their own pigment mastermatching worthwhile. At the same time, however, few can afford to use raw pigment. With these facts in mind, therefore, R-B-H Dispersions offers a line of finely pulverized masterbatched pigments which enable the vinyl processor to have the highest quality of pigment dispersion with minimum handling effort and expense. These R-B-H Plastic Powders are highly concentrated pigment dispersions specifically designed for easy and efficient coloring of dry blend compound, and may also be used for tumble coloring of other thermoplastics including polyethylene, polystyrene, cellulose acetate, saran, cellulose acetate butyrate and ethyl cellulose.

Physically, the powders resemble the corresponding raw pigments, but are not so dusty and have an average particle size between 100-200 mesh. They are readily incorporated into a natural dry blend compound by tumbling; 2-5 minutes in a tumbler or mixer usually give uniform color distribution throughout the batch. Where it is more convenient for the processor to add color at the time of compounding, the powders can be added along



The above are goniophotometric curves of the blue compounds prepared at the Interchemical research laboratories with an instrument for measuring gloss designed and built at the laboratories. These curves were taken at an incidence of 60 degrees. Gloss is indicated by the sharpness and the narrowness of the peaks. Reflection from a mirror, for instance, would be measured as an almost straight, horizontal line with a straight vertical line at the degree of incidence for which the instrument was set.

with the other dry ingredients after the plasticizer has been absorbed by the resin.

The powders are dispersions of pigment in R-B-H Resin 510, a natural, thermoplastic, high melting-type hydrocarbon resin completely compatible with vinyl resins. To date, Resin 510 has never been found to degrade a vinyl extrusion compound in any respect, especially in the small quantities introduced along with the color. In fact, the resin is seriously being considered as a vinyl compounding ingredient because of its extending and plasticizing qualities. The resin is completely insoluble in water, does not reduce the dielectric properties of the compound, and has some stabilizing action on vinyl even though its reaction product with chlorine is chromophoric or dark colored. Resin 510 is quite friable and sufficiently high melting to withstand fine pulverizing without sintering. It is insoluble in alcohol, esters, and ketones; soluble in aromatic and aliphatic solvents; and unaffected by fusion with caustic soda for one hour.

The illustrations, Figure 1, demonstrate the added color yield and improved gloss in an extruded dry blend compound containing R-B-H Plastic Powder as compared with an identical compound containing raw pigment. As mentioned previously, the results obtained with raw pigment can vary greatly, depending on the amount of physical work expended in incorporating the pigment, the compound formulation, and the extruder design and operating conditions. When completely dispersed pigment is used, however, uniform coloring is obtained from batch to batch, and color and tint will not vary between different extruders.

Color Matching

Color matching will always be a chore, but completely dispersed pigment enables the production man to anticipate consistent tinting strength from each pigment in his color blend from batch to batch. Pigment clusters lack color strength, a reason for color variation with poor pigment dispersion. Original color matching is usually done on a laboratory two-roll mill. When a match is determined in this manner, however, and then translated to a dry blend formulation and extruded, the results seldom agree. This illustration is a graphic one of the fact that the extruder does not disperse pigment so well as the laboratory two-roll mill. This fact can be proved by giving the extruded product a subsequent milling to complete the color development and obtain the match. When R-B-H Plastic Powders or other completely dispersed pigment concentrates are used for color matching on the laboratory mill, the extruder will duplicate laboratory results very closely.

Summary and Conclusions

Good pigment dispersion is just as necessary in vinyl dry blend compounding as in other methods of plastics compounding. Since it is difficult to obtain good pigment dispersion in dry blending equipment, and since the pigment is not completely dispersed in the extruder, it is highly advisable for the vinyl processor to use predispersed pigment for his dry blend compound. One suitable method is to predisperse the pigment in vinyl plasticizer on a three-roll ink mill and then dry up the resultant paste with powdered vinyl to obtain a color concentrate which can be added to the dry blend as required. A better, more convenient, and usually less expensive method is the use of finely pulverized masterbatched pigments, such as R-B-H Plastic Powders, for vinyl dry blend.

Advantages to the vinyl processor and extruder of using predispersed pigment for dry blend compounds include: (1) uniformity of color and tint from batch to batch; (2) maximum color strength and brilliance per pound of pigment; (3) elimination of pigment specks, streaks, or pinholes in the extruded product; (4) improved gloss in the finished product; (5) improved dielectric properties in colored insulating compounds; and (6) economy and convenience with reduced inventory, since the natural compound is tumble colored as required.

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German Plastics Industry Booming

Production of plastics in Western Germany soared from 48,000 tons in 1948 and 75,000 tons in 1949, to 168,000 tons in 1951. In the first half of 1952, the amount was 91,000 tons, and the estimated total for the whole year is 190,000 to 195,000 tons. A breakdown of Germany's foreign trade shows that in 1951 exports of plastics materials to the more important markets abroad included 2,581.6 tons of condensation products, valued at 8,982,000 marks; 2,281.8 tons of polymerization products, value 10,761,000 marks; and 1,781.3 tons of cellulose plastics, value 11,065,000 marks. Altogether German plastics went to 44 countries, including besides Australia and New Zealand, 22 countries in Europe, three in Africa, seven in Asia, and ten in the Americas; even the United States bought some 33 tons of plastics materials. More than 80% of the business in condensation and polymerization products, and 55% of the trade in cellulose plastics, was with Europe. The United Kingdom, followed by the

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Meetings and Reports

Reinforced Plastics Meeting Has Record Attendance

A NEW record attendance of 1,420 registrants, more than double the previous high set last year, featured the eighth annual Technical & Management Conference of the Reinforced Plastics Division, Society of the Plastics Industry, Inc., held at the Shoreham Hotel, Washington, D. C., February 18-20. The registration included approximately 300 government personnel as well as representatives from 437 industrial firms. The three-day meeting consisted of morning and luncheon sessions, the annual banquet, afternoon contact periods for registrants, and an exhibit of reinforced plastics products.

WEDNESDAY, FEBRUARY 18

I. M. Scott, Winner Mfg. Co., presided over the morning session, February 18, at which seven papers were presented, as follows: "SPI Reinforced Standards Report," A. L. Smith, Rohm & Haas Co.; "Why Reinforced Plastics?" L. S. Meyer, Western Products, Inc.; "An Evaluation of Several Classes of Fillers for Reinforced Plastics," Louis Linzmeyer, East Coast Aeronautics, Inc.; "Releasing Parts from Molds," James Lunn and Robert Barnett, Lunn Laminates, Inc.; "Finishes for and Surface Qualities of Glass Fiber Reinforced Moldings," B. W. Nelson and C. W. Munton, National Cash Register Co.; "Glass Reinforced Polyester Molding Compounds and Molding Processes," A. G. H. Dietz, Massachusetts Institute of Technology; and "Use of Polyester Resin Preimpregnated Glass Cloth in Mated Die and Vacuum Bag Molding," H. J. Friedman, Russell Reinforced Plastics Corp.

The luncheon session featured a panel discussion of the case histories of successful products, with talks by both the molder and the customer for each product. Hiram McCann, *Modern Plastics,* presided, and panel members were: (molders) R. S. Morrison, Molded Resin Fiber Co., Milton Brucker, Zenith Plastics Co., C. D. Jones, Structurlite Plastics Corp., E. F. Bushman, General American Transportation Corp., and R. B. White, Glastic Corp., Inc.; and (customers) Mr. Nelson, J. M. Eppinger, Herman Miller Furniture Co., O. E. Norberg, Crosley Division of Avco Mfg. Corp., John Brier and John Belber, both of Belber Trunk & Luggage Co., Charles Yarrick, ITE Circuit Breaker Co., and G. C. Harbert, Kaiser-Frazer Corp.

A reception sponsored by materials suppliers followed the afternoon contact period which was devoted to molders and fabricators.

THURSDAY, FEBRUARY 19

The morning session, February 19, was in the form of a government agency forum at which J. B. Alfers, Navy Department Bureau of Ships, acted as moderator, and the following talks were given: "Utilization of Reinforced Plastics in Transportation Equipment," K. T. Marshall, Army Transportation Corps; "Air Force Use of Reinforced Plastics in Aircraft," Major W. G. Ramke, Wright Air Development Center; "Use of Reinforced Plastics in the Coast Guard," Cap. C. E. Brush, Coast Guard; "Adhesives for Reinforced Plastics," H. A. Perry, Naval Ordnance Laboratory; "Chemical Finishes for Glass Fiber Reinforcement," P. W. Erickson, Naval Ordnance Laboratory; "Applications for Low-Pressure Plastic Laminates in Naval Aircraft," J. M. Stevens, Navy Bureau of Aeronautics; "Bureau of Ships' Activities in Reinforced Plastics," W. R. Graner, Bureau of Ships; "Research and Development Board Interest in Reinforced Plastics," Robert Temple, Research & Development Board; "Reinforced Plastics in the Spot Materials Conservation Program of the Department of Defense," F. P. Huddle, Munitions Board; "Effects of Laminating Pressure on Properties of Glass-Fiber Laminates," J. E. Wier, National Bureau of Standards; "Work of Corps of Engineers Industry Advisory Committee on Plastics," George Howard, Fort Belvoir; "Signal Corps Applications of Low-Pressure Reinforced Plastics," E. M. Beekman, Signal Corps Engineering Laboratory; and "Glass-Base Plastics in Ordnance Applications," Gerald Reinsmith, Office of Chief of Ordnance.

J. S. Finger, Corrulux Division of Libbey-Owens-Ford Glass Co., presided over the luncheon-meeting, which featured a talk on "Development Procedures in the Plastics Industry" by Gordon Brown, Bakelite Co. and SPI president, and a forum discussion on "New Developments in the Field of Resins." Forum speakers were H. M. Day, American Cyanamid Co.; E. K. Stigger, Atlas Powder Co.; Marco Wismer, Ciba Co., Inc.; Elmer Warnken, Cincinnati Testing & Research Laboratory; R. E. Dodd, Durez Plastics & Chemicals, Inc.; Wyman Goss, General Electric Co.; S. A. Moore, Interchemical Corp.; I. E. Muskat, Marco Chemicals, Inc.; W. J. Smythe, Monsanto Chemical Co.; P. M. Elliott, Naugatuck Chemical Division, United States Rubber Co.; E. W. Moffett, Pittsburgh Plate Glass Co.; H. A. Hoppens, Plaskon Division, Libbey-Owens-Ford; Deno Laganis, Reichhold Chemicals, Inc.; W. E. Wirsch, Resinous Products Division, Rohm & Haas; and J. E. Carey, Shell Chemical Corp.

The afternoon contact period was devoted to materials, mold, and machinery suppliers, designers, consultants, and government representatives. The day concluded with a social hour and the annual banquet at which Congressman W. H. Judd (Minnesota) spoke on "A Look at What's Ahead."

FRIDAY, FEBRUARY 20

The morning session, February 20, consisted of concurrent technical and management meetings. Two forums were presented at the technical meeting; the first covered equipment, presses, and molds. Mr. Brucker acted as moderator for this forum, and the panel members were: R. J. Brinkema, R. J. Brinkema Co.; R. W. Powell, Hydraulic Press Mfg. Co.; W. B. Goldsworthy, Industrial Plastics Corp.; J. C. Reib, Shaw Industries, Inc.; Mr. Jones, C. F. Kreiser, Edwin L. Wiegand Co.; W. B. Wilkins, consultant; and Irving Green, Zenith Plastics. The second technical forum dealt with "New Developments in Fibrous Reinforcements," and Mr. Goldsworthy acted as moderator. Panel members for this forum were J. H. Plummer, Glass Fibers, Inc.; E. H. Decker, Hess Goldsmith & Co., Inc.; H. A. Fox, Libbey-Owens-Ford; P. Modigliani, Modigliani Glass Fibers, Inc.; F. W. Dennen, Owens-Corning Fiberglas Corp.; H. S. Miller, United Merchants Industrial Fabrics Co.; W. E. Braham, Zenith Plastics; and F. B. Hauserman and R. M. Robb, both of E. I. du Pont de Nemours & Co., Inc.

The management meeting was devoted to discussions of sales problems. Mr. White presided and gave the introductory talk, and formal talks were presented by W. L. Cone, Plastics Mfg. Co.; F. R. Stabrook, Northern Industrial Chemical Co.; Chase Donaldson, Universal Moulded Products Corp.; and Mr. Brinkema.

Richard Malamphy, Naugatuck Chemical Division, presided over the luncheon session, which was highlighted by a talk on "Specialize in Your Own Field: Concentrate!" by Mr. Scott.

The closing afternoon session was in two parts: the first, a general question-and-answer period with a panel composed of previous speakers at the Conference, and the second, a talk on "Development of Fabrication Techniques for High-Temperature Resistant Structural Components" by D. M. Hatch, Jr., Hughes Aircraft Co.

Symposium of Future Developments

FIVE speakers participated in a symposium on "Things to Come—Future Developments in the Plastics Industry" at the March 18 dinner-meeting of the New York Section, Society of Plastics Engineers. Held at the Gotham Hotel, New York, N. Y., the meeting attracted an attendance of approximately 100 members and guests, who joined in the discussion period that followed the talks. Program Chairman Irvin I. Rubin, Robinson Plastics Corp., presided over the symposium, and the speakers were Harold M. Day, American Cyanamid Co.; Wilfred G. Harvey, Guy P. Harvey & Son Corp.; E. V. Hellyar, Monsanto Chemical Co.; Jules A. Jupa, M. W. Kellogg Co.; and Winslow A. Ward, III, American Cyanamid.

Speaking on the polyester resins, Mr. Day reviewed their history and development and described their properties, methods of handling, and the fabricating of Fiberglas reinforced polyester products. Both military and civilian applications of the reinforced plastics were discussed briefly; the speaker noted that some 125 different applications are used by the Armed Services. Newer developments in polyesters include resins that retain their strength at high temperatures, self-extinguishing resins, resins with good electrical properties at high temperatures, and resins that are non-yellowing upon exposure to sunlight. While the future outlook for polyesters is excellent, Mr. Day stated that further technical research will be aimed at lowering costs and accumulating necessary engineering data.

Mr. Harvey described his company's new Cylector, a completely automatic injection molding machine pneumatically operated. Made in a three-ounce capacity, the machine is designed for rapid, laborless operation with minimum maintenance. Employing a measured feed hopper, newly designed heating cylinder, and cartridge-type heaters, the machine is said to pro-

duce parts at a molding pressure of 12,500 psi. that require a pressure of 20,000 psi. in other types of injection machines. Other features of the Cylector include three-tie rod construction; 90-ton clamping pressure; molding area of 54 square inches; stainless steel cylinder components; plasticizing capacity of 60 pounds of acetate and 50 pounds of styrene per hour; two-pressure mold closing to avoid mold damage; automatic shut-off in case of trouble; and 5-6½-inch adjustable plunger stroke. Available accessories such as a discharge and sorting attachment, standard mold bases with built-in degaters, and knockout cylinders aid in reducing labor and handling requirements. The machine is said to have a dry cycle of four seconds and cycles ranging from 7-18 seconds in the actual molding of parts both with and without inserts. Savings of up to 80% in molding labor, and production increases of up to 30% per cavity are obtainable with the new machine, Mr. Harvey declared.

Mr. Hellyar spoke on future improvements which can be expected in thermoplastic materials, particularly styrene. The current trend in styrene is toward impact resistant types, but the future should see the development of such a resin that is comparable in transparency to general-purpose styrene. The future should also bring the development of styrenes that are light stable, solvent and flame resistant, boilable, destaticized, and impact resistant at low temperatures, and show exceptional flow qualities in both copolymer and general-purpose grades. While cost is an important factor, many of these developments can be expected in the near future, Mr. Hellyar stated. Speaking of other thermoplastics, Mr. Hellyar predicted the development of polyethylene with a non-waxy feel; oriented nylon in molded form; vinyl injection-type compounds in a wide range of types; and improved forms of acrylics, cellulosics, fluoroethylenes, epoxies, and silicone resins.

Mr. Jupa described the development, properties, and molding of Kel-F polytrifluorochloroethylene resins. Injection molding of Kel-F requires relatively high pressures, and the use of chromium plated or stainless contact metals to prevent contamination of the material. Extrusion requires the use of screw speeds in the range of 7-10 rpm., and dies 15-25% larger than the finished profile dimensions. Extruded Kel-F can be drawn and oriented to improve strength properties, but the problem of decomposition at very high temperatures is a serious consideration in extrusion. Kel-F can be compression and transfer molded, but the use of fully positive molds is desirable. Dispersions of Kel-F are used for coatings which are fused after being applied and form a clear, continuous film. Kel-F oils and waxes are available for use as impregnants and plasticizers.

Speaking on amino types of thermosetting plastics, Mr. Ward noted that dimensional shrinkage presents the greatest problem with ureas. While great strides have been made in reducing shrinkage, further improvement is needed to approach the shrinkage properties of phenolics. Melamines find their greatest usage in tableware, and the major problem here is coffee staining. A great improvement in this respect can be looked for in the near future, the speaker declared. Recent improvements in amino resins include a transparent thermosetting molding compound that is relatively weak, but provides heat resistance; glass filled melamine with good electrical and dimensional properties that can be compression or transfer molded; and a urea compound for plunger molding. Future research on amino resins is aimed at reducing shrinkage and improving dimensional stability.

Section President Saul Blitz, Noma Electric Corp., presided over the business session that preceded the symposium and introduced some of the guests present. Table favors were distributed through the courtesy of Ideal Toy & Novelty Corp., and the meeting concluded with a drawing for door prizes contributed by Aurora Plastics Corp. and Naugatuck Chemical Division, United States Rubber Co.

CALENDAR

Apr.	15.	Washington Rubber Group. New York Section, SPE. Hotel Gotham, New York, N. Y.
Apr.	20.	American Management Assn. Packaging Conference & Exposition. Navy Pier, Chicago, Ill.
Apr.	20-21.	American Institute of Electrical Engineers. Fifth Annual Technical Conference on Electrical Engineering Problems in the Rubber and Plastics Industries. Mayflower Hotel, Akron, O.
Apr.	20-24.	X-Ray Diffraction School. North American Philips Co., Inc., Mount Vernon, N. Y.
Apr.	21.	Assn. of Consulting Chemists & Chemical Engineers, Inc. Symposium and Dinner, Hotel Belmont Plaza, New York, N. Y.
Apr.	28-30.	Rubber & Plastics Division, ASME. Columbus, O.
May	5.	The Los Angeles Rubber Group, Inc. Hotel Statler, Los Angeles, Calif.
May	7.	Northern California Rubber Group.
May	9-15.	SPI. Annual Meeting and Conference. Cruise on "Queen of Bermuda."
May	13.	Newark Section, SPE. Military Park Hotel, Newark, N. J.
May	15.	Buffalo Rubber Group, and Ontario Rubber Section, C.I.C. International Meeting. General Brock Hotel, Niagara Falls, Ont., Canada.
May	19.	Elastomer & Plastics Group, Northeastern Section, A. C. S.
May	20.	Washington Rubber Group. New York Section, SPE. Hotel Gotham, New York, N. Y.
May	22.	Chicago Rubber Group, Chicago, Ill.
May	27-29.	Division of Rubber Chemistry, A. C. S. Hotel Statler, Boston, Mass.
June	2.	The Los Angeles Rubber Group, Inc. Hotel Statler, Los Angeles, Calif.
June	4.	Northern California Rubber Group.
June	6.	Southern Ohio Rubber Group. Summer Outing. Inland Recreation Center.
June	11.	New York Rubber Group. Annual Outing, Sundance Lodge, Caldwell, N. J.
June	15-19.	Exposition of Basic Materials for Industry. Grand Central Palace, New York, N. Y.
June	19.	Boston Rubber Group. Summer Outing. Akron Rubber Group. Summer Outing. Firestone Country Club.
June	23.	Buffalo Rubber Group. Summer Outing.
June	29.	American Society for Testing Materials. Annual Meeting, Chalfonte-Haddon Hall Hotel, Atlantic City, N. J.
July	3.	
July	24.	Chicago Rubber Group. Summer Outing.
Aug.	4.	New York Rubber Group. Golf Tournament, Baltusrol Golf Club, Springfield, N. J.
Sept.	9-11.	Division of Rubber Chemistry, A. C. S. Sherman Hotel, Chicago, Ill.
Sept.	17.	Southern Ohio Rubber Group. Engineers' Club, Dayton, O.

Discuss Automatic Molding

Two talks on "New Developments in Fully Automatic Compression Molding," by Quentin M. White and S. H. Greenwood, both of F. J. Stokes Machine Co., featured the March 11 dinner-meeting of the Newark Section, SPE. Some 90 members and guests attended the meeting, which was held at the Military Park Hotel, Newark, N. J., and presided over by Section President J. R. Pecktal, Eastman Chemical Products, Inc. The speakers were introduced by Program Chairman Don Biklen, Orangeburg Mfg. Co.

Mr. White dealt with the basic concepts of fully automatic molding and described the Stokes presses together with their impact on the compression molding industry. Mr. Greenwood's talk covered multi-screw extruders and was identical with the paper he presented at the recent SPE National Conference.[1]

[1] For abstract, see our Feb., 1953, issue, p. 657.

Vinyl Film as Silage Protector

MONSANTO CHEMICAL CORP., Springfield, Mass., has reported completion of field tests demonstrating the successful use of Ultron LTF vinyl as a protector for grass silage. Forage may now be cut and covered the same day, permitting safe outdoor storage of silage crops and elimination of preliminary curing periods. The film, which is 0.004-inch thick, is available in a standard size of 22 by 30 feet, but may be bonded together with vinyl tape to permit airtight coverage of larger areas.

Discuss Expanded Vinyls

A TALK on "Expanded Vinyl Plastics" by Martin J. Kleinfeld, Naugatuck Chemical Division, United States Rubber Co., highlighted the February 17 meeting of the Elastomer & Plastics Group, Northeastern Section, A. C. S. Approximately 70 members and guests attended the meeting, which was held at Massachusetts Institute of Technology, Cambridge, Mass., and was preceded by a separate dinner at Smith House.

Mr. Kleinfeld traced the development of expanded vinyls since their beginnings in Germany during the war. Four methods were used in Germany to make plastic foams: (1) whipping air into the viscous resin mixture; (2) forming gaseous reaction products during polymerization; (3) pressurizing the plastic with inert gas; and (4) using chemical blowing agents. This last method has proved most valuable in current production of expanded vinyls, and the most widely used blowing agents are Celogen and Unicel ND.

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Scientific and Technical Activities

ASTM Spring Meeting in Detroit Includes Committee D-11 and SAE-ASTM Technical Committee A

THE spring meeting and committee week of the American Society for Testing Materials held in Detroit, Mich., during the week of March 2, included a meeting of Committee D-11 on Rubber and Rubber-Like Materials and of the joint Technical Committee on Automotive Rubber of the Society of Automotive Engineers and ASTM. The meeting of Committee D-11, preceded by meetings of its several subcommittees, was held March 6 at the Hotel Statler, and the meeting of Technical Committee A, at Rackham Memorial Building on March 4.

A cocktail party and dinner was held by the Detroit District Council of ASTM on March 4 at the Hotel Statler. The dinner featured a talk by Kenneth McFarland, educational consultant to General Motors Corp., who spoke on "Fathoming the Fifties" in an extremely interesting and informative manner. The dinner was also honored by the presence of ASTM President H. L. Maxwell and Executive Secretary R. J. Painter.

Committee D-11 Meeting

The meeting of Committee D-11 on March 6 was presided over by H. G. Bimmerman, E. I. du Pont de Nemours & Co., Inc., vice chairman, in the absence of Chairman Simon Collier, Johns-Manville Corp. Secretary A. W. Carpenter, B. F. Goodrich Co., reported that the Standards Committee had approved all the recommendations of Committee D-11, and that they were now incorporated in the December, 1952, edition of "ASTM standards on Rubber Products."

It was announced that J. F. Kersher, Goodyear Tire & Rubber Co., had been appointed chairman of a new subcommittee to develop compound classifications for general use, such classifications not to conflict with those for automotive rubber products now listed in the tables in D735-52aT, Specifications for Rubber and Synthetic Rubber Compounds for Automotive and Aeronautical Applications.

Technical papers for presentation before meetings of Committee D-11 were solicited, with special reference to the meeting in Atlantic City, N. J., the week of June 29.

A resolution was passed to authorize the officers and advisory committee of Committee D-11 to approve representatives from D-11 for the meeting of the International Organization for Standardization, Technical Committee 45 on Rubber, in Paris, France, June 15-20, 1953, when these representatives are known. The American Standards Association, official American member of the ISO, will provide the necessary certification when advised by ASTM Committee D-11.

A motion was passed in favor of holding the ASTM spring meetting in early February instead of early March.

D-11 Subcommittee Meetings

Subcommittee 5—Wire and Cable. John T. Blake, Simplex Wire & Cable Co., chairman. It was voted to submit the butyl rubber insulation specification to letter ballot. The polyethylene insulation specification was also considered.

The results of the subcommittee letter ballot on the proposed construction specifications for wire and cable and the associated revisions of the present ASTM specifications D353, Natural Rubber Performance Compound for Wire and Cable; D469, Natural Rubber Heat Resisting Compound; D574, Ozone Resistant Type Insulation; D754, Synthetic Rubber Heat Resisting Compound; D755, Synthetic Rubber Performance Compound; D532, Natural Rubber Sheath Compound; and D753, Light Duty Neoprene Sheath Compound, were discussed. A section will make further revisions in these specifications, and they will then be submitted to letter ballot in the subcommittee again before the June meeting.

Subcommittee 6—Packings. F. C. Thorn, Garlock Packing Co., chairman. The subcommittee asked that the following seven changes in D1147-52T, Method of Test for Compressibility and Recovery of Gasket Materials, be submitted to Committee D-11 for letter ballot:

(1) Paragraph 2b, "Penetrator diameter for various types of gasket materials are as shown in Table 1 unless otherwise specified."

(2) Paragraph 2d, "Preloads for various types of gasket material are as shown in Table 1 unless otherwise specified."

(3) Paragraph 2e, next to last sentence, "The major load shall be in addition to the specified load."

(4) Paragraph 2e, last sentence, "Major loads for various types of gasket materials are as shown in Table 1 unless otherwise specified."

(5) Table 1, in title, omit "recommended."

(6) Table 1, change values in "major load" column to read respectively, 245 lbs., 79 lbs., 45 lbs., 49 lbs., 49 lbs., 99 lbs., 49 lbs., 49 lbs. Add final column entitled "sum of major load and preload" with values as in present column entitled "major load."

(7) Paragraph 4, last sentence, "Conditioning procedures for various types of gasket materials are as shown in Table 1 unless otherwise specified."

The above changes 1, 2, 4, 5, and 7 were voted at a meeting on March 5, 1952, but did not find their way into the new D-11 handbook. Changes 3 and 6 are new and are designed to clear up ambiguities in the method as written.

The subcommittee also recommended the following changes in D733-52T, Method of Testing Compressed Asbestos Sheet Packing, to be submitted to Committee D-11 for letter ballot:

(1) Paragraph 5, last sentence, substitute for "around the borders of the article" the words "over the area of the article." The idea here is not to limit measurements to the border if the center happens to be accessible.

(2) Paragraph 8, last sentence, substitute for "250 lbs." the figure "245 lbs." to be consistent with the change in D1147.

(3) Paragraph 10, omit second and last sentences since they contradict statements in D1147.

The section on rubber sheet specifications promised a report at the June meeting. The chairman was authorized to reply directly to the General Services Administration in response to a request for an opinion on proposed revision of specification HHG156b.

Subcommittee 10—Physical Testing. L. V. Cooper, Firestone Tire & Rubber Co., chairman. A task group was appointed to investigate the reproducibility of the present buffing method in D15-52T, Methods of Sample Preparation for Physical Testing of Rubber Products; the investigation should include testing of finished products of pure gum and loaded stocks.

In connection with a suggestion that the standard compounds and ingredients in D412-51T, Tension Testing of Vulcanized Rubber, be extended to the evaluation of unknown plasticizers and fillers, it was decided to revise the scope of this specification so as to define more precisely testing with standard and non-standard ingredients.

A suggestion that the term "equivalent cure," with special reference to thick samples, be defined in D412-51T, was tabled.

A report by D. C. Scott, Jr., Scott Testers, Inc., on a survey of available means of measuring the temperature of rubber during mill mixing revealed that the methods for such temperature measurement and even for measurement of roll surface temperatures have not been very well worked out. Some attempts have been made to use a radiation pyrometer for measuring the temperature of the rubber, but this method is too sensitive to the effects of dust, steam, etc., in the air at the time of measurement. The National Bureau of Standards is working on an improved apparatus for the measurement of roll surface temperatures.

Subcommittee 12—Crude Natural Rubber. N. Bekkedahl, NBS, chairman. The two methods for the quantitative determination of dirt in crude natural rubber, published in ASTM Special Technical Publication 136, February 1953, entitled "Symposium on Evaluation of Natural Rubber," were recommended for letter ballot in both subcommittee 12 and Committee D-11; the adoption of the methods by D-11 is dependent on their complete acceptance by subcommittee 12. The two methods are recommended for adoption as tentative standards.

The subcommittee voted to instruct the American delegation from the ASA to the meeting of the International Organization for Standardization in Paris in June to present the above-mentioned quantitative procedures for the dirt content of crude natural rubber and the standard procedures in Committee D-11's method D297, Chemical Analysis of Rubber Products, for the determination of copper and manganese, with possible modification of the copper method, to that meeting. The American delegation to the ISO meeting is also to present the views of subcommittee 12 on the research and development method for the measurement of vulcanization behavior of crude natural rubber which includes the time of incipient cure and rate of cure as determined from Mooney viscosity of the A. C. S.-1 compound as a function of time at vulcanizing temperatures, in addition to the measurement of strain or modulus of the A. C. S.-1 vulcanizate cured 40 minutes at 140° C.

A report on the analysis of dirt on the samples used in developing the above-

mentioned subcommittee 12 methods was submitted by Rolla H. Taylor, United States Department of Agriculture, Salinas, Calif.

Subcommittee 15—Life Tests for Rubber Products. G. C. Maassen, R. T. Vanderbilt Co., chairman. Section 1 on the aging of plastics reported that there was no need of further work by Committee D-11 until the results of aging tests being conducted by Committee D-20 on Plastics and the Society for the Plastics Industry were completed and the results analyzed.

Section 2 on the correlation between oven and shelf aging of rubber products is awaiting a report from subcommittee 28 on the best method of analysis of the results obtained to date following two-, three-, and four-year shelf aging, when compared with oven aging for shorter periods.

Section 3 on the unification of tests for natural and synthetic rubbers reported that the method for aging determination by the measurement of creep, D1206-52T, is now included in the 1952 book of standards of Committee D-11.

Section 4 on miscellaneous properties and their effect on light aging reported that the results of work done to date in the Ordnance Department program were being reviewed and prepared for publication.

Section 5 on the development of test methods for measuring ozone resistance, headed by A. E. Juve, B. F. Goodrich Research Center, gave a resumé of results obtained to date in a round-robin test in which seven compounds are being tested in ozone cabinets and by outdoor exposure. Preliminary analysis shows poor agreement, but if two compounds, one natural rubber plus wax and the other GR-S plus wax, are eliminated, reasonable agreement is evidenced. Calibration of the various ozone cabinets is now underway.

Section 9 on light source calibration reported the results of a questionnaire circulated to learn the use and adherence to ASTM D749-43T and D750-43T, the Method of Calibrating a Light Source Used for Accelerating the Deterioration of Rubber, and the Method of Test for Resistance to Accelerated Light Aging of Rubber Compounds, respectively. It was recommended that D749 and D750 be referred to Committee E-1, subcommittee 14, since the subject of light source calibration is a problem for many industries, including rubber.

It was mentioned that Committee E-1 has developed specification E95-52T for a standard cell-type aging oven.

At the request of SAE-ASTM Technical Committee on Automotive Rubber Products, it was recommended that D573-52, Method of Test for Accelerated Aging of Rubber by the Oven Method, be amended to include the use of temperatures of 100° C., and above, in intervals of 50° C.

Another request from Technical Committee A for the inclusion of a bend test in D573-52 and D865-52T, Method for Heat Aging of Vulcanized Natural or Synthetic Rubber by Test Tube Method, was referred to subcommittee 10 on Physical Tests.

Subcommittee 15 recommended to Committee D-11 that D454-52, Method of Air Pressure Heat Test of Vulcanized Rubber; D572-52, Method of Test for Accelerated Aging of Vulcanized Rubber by the Oxygen-Pressure Method; and D573-52 and D865-52T be amended to *require* the bench *mark* to be placed on the test *specimens* after aging.

Subcommittee 17—Hardness, Set and Creep. Sherman R. Doner, Raybestos-Manhattan, Inc., chairman. A report on "Stress Relaxation Tests on Soft Gasket Stocks," by C. K. Chatten, New York Naval Shipyard, was distributed. The results of this work were quite inconsistent, and after discussion it was agreed that the cooperating laboratories should try to come to some agreement for further work.

The request of Technical Committee A for additional higher temperatures for aging specifications was referred to Committee D-11 to determine what temperatures should be adopted because it is desired to use the same temperatures for compression set testing, and these temperatures involve the work of not one but several subcommittees.

The following change in D395-52T, Tests for Compression Set of Rubber, were recommended for letter ballot: Delete the second paragraph of 8c under "Heat Treatment," which reads, "Before inserting the test specimen in the compression device, the compression device shall be preheated for a sufficient length of time, etc." and substitute in its place, "The test specimen shall be at room temperature when inserted in the compression device."

Discussion of the negative ballots on D314-52T, Method of Test for Hardness of Rubber, was deferred until the June meeting.

The Rex hardness gage including a new direct reading scale was exhibited.

Subcommittee 19—Immersion Tests. W. N. Keen. du Pont, chairman. M. E. Marks, Columbia-Southern Chemical Corp., was appointed the representative of subcommittee 19 on subcommittee 28, Statistical Quality Control.

Editorial revisions in D471-52T, Methods of Test for Changes in Properties of Rubber and Rubber-Like Materials, will be made by the subcommittee chairman with the assistance of ASTM headquarters, and submitted to subcommittee letter ballot before June.

A task group was appointed to modify the scope of D471-52T, to exclude certain materials, such as, compressed asbestos sheet, cellular rubber, etc. This group consists of F. C. Thorn, S. R. Doner, and N. G. Duke, B. F. Goodrich Chemical Co.

It was agreed that the word "specimen" in paragraph 3d of D471 shall be changed to "sample." No changes in the volume of immersion media will be made.

Subcommittee 20—Adhesion Tests. L. E. Cheyney, Minnesota Mining & Mfg. Co., chairman. The subcommittee chairman presented a recent request from the ISO Technical Committee 45 on Rubber, requesting specific recommendations for standard temperature and humidity to be employed in testing the adhesion of rubber to synthetic textiles. The standard conditions as recommended in E41-48T, Conditioning and Weathering, were approved.

The task group on revision of D429-47T, Method of Test for Adhesion of Vulcanized Rubber to Metal, presented a proposed round-robin testing program. At the request of the subcommitttee chairman, the task group chairman will write in complete detail the scope of the proposed program for circulation in the subcommittee before presentation to subcommittee 28 for advice on adequacy. Meanwhile the task group is undertaking an inter-laboratory comparison to determine the reproducibility of test data.

The need of some standard test to demonstrate the effect of migrating or blooming of ingredients of cured rubber compounds on the adhesion obtained with rubber or other materials was discussed. The matter was referred to the advisory committee of D-11 as being outside the scope of subcommittee 20, and the formation of a new subcommittee was suggested.

Subcommittee 21—Rubber Cements and Related Products. J. F. Anderson, Goodrich, chairman. The results of a round-robin testing program to determine soundness of the new method D1205-52T, Testing of Adhesives for Brake Lining and Other Friction Materials, were discussed. The test data correlated well, and it was agreed that the new method was satisfactory. Certain revisions in some of the sections of the method on testing appear desirable and will be submitted to letter ballot.

Section 16 of D1205 on the flow testing of aged bonding tape and cement film requires revisions that seem to call for further investigation of a fundamental nature, and a task group headed by George Koehn, Armstrong Cork Co., was appointed for this work.

R. G. Westerman, Ford Motor Co., requested a method of test for determining or predicting adhesion failure of rubber compounds cemented to rubber, metal, etc., such as, when sponge strips are cemented to metal in automobile manufacture. Presumably, migration of waxes, plasticizers, and other ingredients from the rubber compounds to the surface cemented results in loss of adhesion. The matter was referred to the advisory committee of Committee D-11, which is already considering the formation of a new subcommittee to investigate this matter.

Subcommittee 23—Hard Rubber. G. A. Kanavel, Vulcanized Rubber & Plastics Co., acting chairman. The asphalt section discussed the requirements for a testing machine suitable for the new drop impact test in D639-52T, Testing of Asphalt Composition Battery Containers. Test data for two existing machines will be determined and presented at the June meeting, and drawings for another new machine will also be submitted.

The problem of determining failure in the sensitivity to hot-cold cycles of D639 was discussed and two different procedures will be circulated at the June meeting for discussion.

There was also some discussion of how to express acid absorption, that is, as a weight gain per unit surface area instead of the percent weight gain, and data will be accumulated for consideration in June.

The hard rubber section discussed adapting the drop impact test of D639 to hard rubber containers. Modifications of test procedure and machines were discussed.

Subcommittee 25—Low Temperature Tests. R. S. Havenhill, St. Joseph Lead Co., chairman. O. H. Smith, United States Rubber Co., circulated a draft of a tentative procedure for the T-R (temperature-retraction) test method, which met with general approval. There was considerable discussion, however, regarding the use of 50% and intermediate elongations on samples which would not stretch 250%. It was felt that a note could be added to the method stating that for studying long-time exposures at low elongations, a 50% elongation could be used and J. E. Gaughan, Ordnance Dept., Detroit Arsenal, and P. J. Earley, General Tire & Rubber Co., agreed to assist Mr. Smith in this connection. It was also agreed to include the use of gaseous media when the design of the apparatus was such that tests using it would duplicate those obtained with the standard liquid media.

The round-robin test comparing the use of solenoid *versus* motor driven equipment for use with D746-52T, Method of Test for Brittleness Temperature of Plastics and Elastomers by Impact, was reported

as incomplete by I. Kahn, Ordnance Dept., substituting for A. C. Hanson, also of Ordnance, and chairman of the section in charge of this investigation. In this connection Mr. Kahn stated that the military specification MIL-R-3065 now specifies D746 with solenoid or motor driven equipment, in place of D736-46T, Method of Test for Low-Temperature Brittleness of Rubber and Rubber-Like Materials.

J. J. Allen, Firestone, pointed out that manufacturers of automotive rubber products were not satisfied with D746 and requested either a "go-no go" provision in it, or the development of a new method incorporating the D746 apparatus in the D736 method. After considerable discussion, the subcommittee chairman was authorized to appoint a section to investigate this matter. The new section will consist of W. N. Keen, chairman; C. G. Cashion, Firestone; R. F. Shaw, Ordnance Dept.; and W. A. Zinzow, Bakelite Corp.

It was reported by Mr. Kahn that the Gehman apparatus, as made by American Instrument Co., does not satisfy the requirements of D1053-52T, Measuring Low Temperature Stiffening of Rubber and Rubber-Like Materials by the Gehman Torsional Apparatus, in that the variations in the cold temperature are more than the specified plus or minus 1° C. He suggested the use of a fan in the cold chamber, expansion of the procedure to permit testing in liquid media, and the use of the instrument in a cold box or cold room. A section consisting of Mr. Shaw, chairman; B. G. Labbe, Government Evaluation Laboratory; and Ross Shearer, Goodrich Research Center, was appointed to study the problem.

ISO TC 45 Document 157, a summary of the comments of the United Kingdom delegation on American cold resistance test methods, was discussed, and there was general agreement with these comments. F. S. Conant, Firestone, pointed out, however, that transition temperatures are usually below the temperature of serviceability of rubber goods, and a transition temperature method, while of theoretical interest, might not be of much use when applied to service problems.

J. R. Britt, Navy Department, reviewed the highlights of the second Armed Forces symposium on low temperature testing. A summary of this symposium will be published soon in the rubber trade journals.

Subcommittee 26—Processibility Tests. Rolla H. Taylor, chairman. Mr. Shearer, chairman of the section appointed to study: (1) the effect of sample preparation on the Mooney viscosity of natural rubber; and (2) the effect of types and kinds of surfaces and the dimensions of the dies, die holders, and rotors on Mooney viscosity, reported on the sample preparation studies. To date, the section, consisting of five cooperating laboratories, has found that for one bale of #2 RSS a satisfactory method of preparation is to pass the rubber through a two-roll mill eight times with a roll temperature of 140° F., and a setting of 0.055-inch. The rubber was folded on itself once for each pass. The section intends to study sample preparation of other grades of natural rubber before making final recommendations.

George Decker, NBS, discussed a report to Office of Synthetic Rubber, RFC, on "The Influence of Variation in Rotor, Dies, and Rate of Shear on the Mooney Viscosity." On the basis of this report and to comply with the request of ISO TC 45 Resolution 226, subcommittee 26 requested Committee D-11 to submit the following proposed changes in D927-52T, Method of Test for Viscosity of Rubber and Rubber-Like Materials by the Shearing Disk Viscometer, to letter ballot:

1. Delete Figure 1, and insert a similar drawing of the NBS Mooney viscometer.

2. Revise paragraphs 2a and 2c to include dimensions of the serrations, the pin in the center of the upper die, the counterbore in the center of the rotor head, and the diameter of the rotor shaft.

Also, specify that rotors with broken serrated edges shall be discarded, and that the rotor shaft shall bear on the vertical shaft and not on the lower die.

The dimensions mentioned above are to be those specified by Scott Testers for the manufacture of the parts in question and are to be supplied by that company.

The subcommittee recommended that the American delegation to the ISO TC 45 meeting in Paris in June report these recommendations to that body and also inform it of the progress of subcommittee 26 in sample preparation procedure and of Mr. Decker's above-mentioned report.

G. N. Vacca, Bell Telephone Laboratories, chairman of the section on the use of metric or English units in D926-47T, Method of Test for Plasticity and Recovery of Rubber and Rubber-Like Materials by the Parallel Plate Plastometer, reported by letter in favor of the metric units. Subcommittee 26 recommends, therefore, that D926 be changed from English to metric units, wherever they appear.

H. V. Storey, U. S. Rubber, was appointed to represent subcommittee 26 on subcommittee 28, statistical quality control methods. It was suggested that the section on sample preparation of natural rubber for Mooney viscosity determinations submit its proposed plan for further investigation to subcommittee 28, through Mr. Storey, for comment and advice.

Subcommittee 27—Resilience. E. G. Kimmich, Goodyear, chairman. Subcommittee 27 did not meet, but the chairman recommended for letter ballot in Committee D-11 the change in paragraphs 5a and 5b of D1054-49T, Method of Test for Impact Resilience and Penetration of Rubber by the Rebound Pendulum, from 82 ± 2° F. to 73.4 ± 2° F., in order that the temperature agree with that called for in D412.

Subcommittee on Standard Samples. A. E. Juve, chairman. The objective of establishing a series of standard recipes and procedures for the compounding and mixing of rubber has been accomplished and is now a part of D15-52T.

The assignment is not completed, however, inasmuch as there is still no source for the polymers or for certain compounding ingredients. One new standard ingredient has been added to the list by NBS: phenyl beta naphthylamine, available as NBS Standard Sample No. 377 at $4 for a 600-gram sample.

Further work on this project at the Bureau of Standards is at a standstill because of limitations in fund and personnel.

Committee E-1, Task Group B Meeting

A meeting of Task Group B on Low Temperature Testing of Elastomers and Plastics of Committee E-1 on Methods of Testing was held at the Hotel Statler on March 5. R. S. Havenhill is chairman of this Task Group.

Section 1 on stiffness testing presented a final report on nine stiffness tests on natural rubber, GR-S, and polyethylene at temperatures ranging from +73.4 to —80° F., including pertinent comments on limitations and advantages of the different types of tests. A condensed version of the report will be prepared for publication in the technical journals.

Section 2 on hardness testing reported that the results of a round-robin testing program have been tabulated and will be distributed at the next meeting. A method of cleaning and lubricating and any special precautions necessary to operate dial gage instruments at low temperatures will also be distributed at the next meeting.

Section 3 on correlation of Navy Department, Bureau of Ships, tests reported progress on correlation of different hardness tests and will present a report including correlation curves at the next meeting.

Highlights of the Second Armed Forces Symposium on Low Temperature Testing were presented, and a discussion of ISO TC 45 Document 157, as reported by subcommittee 25 of D-11 also, was held.

SAE-ASTM Technical Committee on Automotive Rubber

A brief report of the activities of the SAE-ASTM Technical Committee on Automotive Rubber was made by Mr. Allen, secretary. The usual three quarterly meetings were held since last June; the latest meeting took place at Rackham Building in Detroit, March 4.

Section 1 on automotive vibration insulators is conducting a round-robin test to determine the reproducibility of tests made with the Yerzley oscillograph. A study is also being made of a practical test method for engine mounts, and in this connection the problem of a dynamic test machine is being considered.

Section 3 is considering several proposed changes in the various automotive hose specifications.

Section 4 on classification and specifications for automotive rubber compounds has several sub-sections. Of these, 4b is working on a specification for colored mats to include discoloration and water spotting tests and on a method for the evaluation of color coatings.

Sub-section 4d on the automotive compound tables in ASTM D735 has incorporated all the latest revisions in the present printing in the Committee D-11 handbook.

Sub-section 4g on ozone testing report is the same as that given by Mr. Juve in D-11 subcommittee 15.

Sub-section 4i on rubber-like plastics has submitted a proposed specification for nonrigid plastics for automotive use to SAE and ASTM for approval and publication.

Sub-section 4l on low-temperature properties is concerned with the proposal to use the solenoid actuated apparatus of D746 in the D736, or Thiokol bend test method. A round-robin test is being run to determine the extent of correlation between the apparati in D746 and D736 for brittleness testing. The cooperation of D-11 subcommittee 25 in this work is appreciated by Technical Committee A.

Sub-section 4n on sponge rubber has approved the latest revision of the foamed latex and sponge rubber specifications, but has suggested a revision of the water absorption test for letter ballot in D-11.

Sub-section 4o on silicone and acrylic elastomer compounds for automotive use is continuing its work aimed toward further improvement of the specifications of these elastomer compounds in the D735 tables.

Sub-section 4p on static exposure testing is now starting the second year of a round-robin test involving the exposure of six different samples in 18 different locations each month. A large amount of data on the rate of cracking of rubber at different seasons of the year and in different locations is being evaluated with the aim of writing a specification for outdoor weather aging and correlating the results of outdoor aging with laboratory accelerated ozone aging tests.

Sub-section 6 on V-belts is submitting some revisions of the SAE V-belt specifications to the Society for approval. The section is also consulting with the Ordnance Dept. on its V-belt specifications.

Sub-section 9 on hydraulic brake cups has expanded the scope of its work to include brake boots, and a tentative specification for the latter is now being studied.

Sub-section 10 on gaskets has approved revisions in the automotive gasket specifications and is submitting them to letter ballot in Technical Committee A.

Sub-section 12 on preparation of a manual on laboratory procedure has decided to submit again the proposal that such a manual be prepared to letter ballot in Technical Committee A. Discussion at the last meeting indicated some doubt that this project was within the scope of the work of the section.

Rubber and Synthetic Rubber Compounds for Automotive and Aeronautical Applications[1]

THE American Society for Testing Materials and the Society of Automotive Engineers recently published the 1952 revision of the SAE-ASTM Specifications for Rubber and Synthetic Rubber Compounds for Automotive and Aeronautical Applications (ASTM D735; SAE 10R). These specifications have been prepared by the Technical Committee on Automotive Rubber, which is jointly sponsored by these two societies, and is composed of technologists from both the automotive and rubber industries.

The results of their work were first released in 1943 as ASTM D735 and SAE Standard 10R. A revision of this specification was published in 1948, and a further revision in 1951. These specifications establish a means of classifying and describing by standard methods the many rubber and synthetic rubber compositions in use in automotive rubber products. While many industrial and mechanical goods applications also may be adequately and conveniently served by the classification system, the Committee did not intend that its specifications describe compounds for tires, inner tubes, sponge rubber, belts, hose, mats, hard rubber, and insulated wire and cable, or those prepared from latex.

In former versions of these specifications, an attempt was made to segregate natural rubber compounds from those made from GR-S. In the present revision this segregation was discontinued. Rubber and synthetic rubber compositions are divided into two basic types: Those requiring no specific resistance to the action of petroleum-base fluids are identified as Type R; and those requiring specific degrees of resistance are identified as Type S. This year a new classification of synthetic rubber compounds has been added. This classification identified by Type T describes compositions having specific resistance to the effect of prolonged exposure to abnormal temperatures and to compounded petroleum oils. Type R compounds are not further described as to classes of elastomers, and it is the Committee's intention that they be prepared using natural, reclaim, and synthetic rubber, or mixtures thereof, as the base, provided the requirements of the specifications are met. The Type S compositions, normally used where resistance to swelling action by oil is required, are subdivided into three classes. Class SA describes compositions having very low volume swell in petroleum hydrocarbons. In practice such compounds are normally made from polysulfide-organic dihalide polymers (Thiokol). Class SB compounds are characterized as having low volume swell in petroleum hydrocarbons and normally describe compounds made from copolymers containing acrylonitrile. Class SC describes compounds having medium volume swell in petroleum hydrocarbons. Such compounds are normally made from neoprene as the base material.

Type T compounds are divided into two classes. Class TA compounds are intended for services where outstanding resistance to change by extreme heat and cold is required. These compositions are normally made from silicone. Class TB compounds are intended for services where outstanding resistance to change by severe heat and in hot petroleum hydrocarbons, including those modified with sulfur compounds, is required. These compositions are normally made from silicone. Class TB compounds are intended for services where outstanding resistance to change by severe heat and in hot petroleum hydrocarbons, including those modified with sulfur compounds, is required. These compositions are normally made from polyacrylic rubbers as the base material.

The specifications further provide for different grades within each class. The grades are designated by a number representing the hardness, and tensile strength properties of the stock. In the former versions of these specifications these properties constituted the basic requirements for the non-oil resistant Class R. In the present revision, resistance to change in hardness and tensile strength properties after oven aging has been retained as a basic requirement. The former compression set requirement specified as Suffix "B" has been retained as part of the basic requirements, and the values for Suffix "B" compression set, as in last year's version, require for their fulfillment the development of low set types of compounds. Another change has been in the suffix letter designations for low-temperature requirements. Suffix "F" requiring low-temperature test at —40° F. is now identified as Suffix "F[1]"; likewise Suffix "FF" requiring low temperature test at —65° F. is now Suffix "F[2]." In the tables for oil resistant Type S compounds, basic requirements formerly included hardness, tensile strength, and elongation and the change in volume after aging in oil. In the revised specifications, change in volume in both high and low aniline point oils, change in tensile strength, elongation and hardness after aging in the air oven and compression set have been retained as basic requirements. Compression set under the Suffix "B" has been continued and requires the development of stocks especially compounded to have low compression set characteristics.

The following letters designating additional quality requirements have been provided so that the purchaser may specify requirements in addition to the basic requirements. These suffix requirements may be applied singly or in combination in further describing any grade. These additional suffix letters and their requirements are as follows:

Suffix Letter	Requirement
C	Weather resistance test. As yet no standard method is available.
D	Load deflection test. Values have been established for Type R compounds only, and the test is conducted in accordance with "Standard Methods of Test for Compression-Deflection Characteristics of Vulcanized Rubber" (ASTM Designation D575).
E[1]	Oil immersion test. Values are specified for Classes SA, SB, SC, and TA. These tests are made in ASTM Petroleum-Base Oil No. 1, as specified, according to "Tentative Methods of Test for Changes in Properties of Rubber and Rubber-Like Materials in Liquids" (ASTM Designation D471).
E[3]	Oil immersion test. Values are specified for Classes SA, SB, SC, and TA. These tests are made in ASTM Petroleum-Base Oil No. 3, as specified, according to "Tentative Methods of Test for Changes in Properties of Rubber and Rubber-Like Materials in Liquids" (ASTM Designation D471).
E[4]	Oil immersion test. Values are specified for Class TB. Tests are made in a blend of Petroleum-Base Oil No. 1 and a hydrocarbon composition containing sulfur and chlorine constituents of controlled activity toward metal surfaces. This composition is a typical additive for extreme pressure lubricants. The test is made according to the methods of ASTM Designation D471, "Tentative Methods of Test for Changes in Properties of Rubber and Rubber-Like Materials in Liquids."
F[1]	Low-temperature tests at —40° F. This is a brittleness test conducted according to "Tentative Method of Test for Low Temperature Brittleness of Rubber and Rubber-Like Materials" (ASTM Designation D736).
F[2]	Low-temperature tests at —65° F. This is a brittleness test conducted according to "Tentative Method of Test for Low Temperature Brittleness of Rubber and Rubber-Like Materials" (ASTM Designation D736).
G	Tear test. No values are specified. However the test is conducted according to "Standard Methods of Test for Tear Resistance of Vulcanzed Rubber" (ASTM Designation D624).
H	Flexing test. No values are specified. However the test is conducted according to "Tentative Methods of Test for Dynamic Ply Separation and Cracking of Rubber Products" (ASTM Designation D430).
J	Abrasion test. No values are specified. However the test is conducted according to "Tentative Methods of Test for Abrasion Resistance of Rubber Compounds" (ASTM D394).

[1] Prepared by N. L. Catton, E. I. du Pont de Nemours & Co., Inc., Chairman, Section 4D, SAE-ASTM Technical Committee A.

K Adhesion test. No values are specified. However the test is conducted according to "Tentative Method of Test for Adhesion of Vulcanized Rubber to Metal" (ASTM Designation D429).

L Moisture absorption test. Values are specified for Class TA. The test is conducted according to "Tentative Methods of Test for Changes in Properties of Rubber and Rubber-Like Materials in Liquids" (ASTM Designation D471).

M Inflammability test. No values are specified. As yet no standard method is available.

N Repeated impact test. No values are specified. As yet no standard method is available.

P Staining test. No values are specified. However the test is conducted according to "Tentative Methods of Test for Contact and Migration Stain of Vulcanized Rubber in Contact with Organic Finishes" (ASTM Designation D925).

R Resilience test. Values are specified for Classes R and SC. The test is conducted according to "Tentative Methods of Test for Mechanical Properties of Elastomeric Vulcanizates under Compressive or Shear Strains by the Mechanical Oscillograph" (ASTM Designation D945).

Z Special tests. Any special characteristics of functional requirements, other than those prescribed by the other suffix letters, which may be desired for specific applications (for example, resistance to ozone or special fluids) shall be specified under Suffix **Z.**

These suffix requirements provide the consumer great versatility in describing the specific requirements for a given rubber product.

While standard numerical limits and test methods have not been established for all the requirements denoted by suffix letters, it is the Committee's intention to provide this information at the earliest opportunity. Further work of the Committee will be directed toward even greater simplification of the specification which should result in making it even easier for the engineer to use.

It is recognized that these specifications are being used by industries other than the automotive industry. It must be remembered, however, that the specifications are subject to revision when required by automotive needs, and there is no assurance that the changes will be acceptable to all other users.

Akron Group Symposium on Crude Rubber and GR-S

"GR-S *versus* Crude Rubber" was the subject of a symposium sponsored by the Akron Rubber Group at its mid-winter meeting on January 30 at the Mayflower Hotel, Akron, O. More than 600 members and guests attended the afternoon technical session at which questions submitted by the audience were answered by an panel composed of A. E. Hosier, Faultless Rubber Co.; C. Boyd Cook, Wooster Rubber Co.; Daniel Reahard, Jr., General Tire & Rubber Co.; John E. Brothers, Ohio Rubber Co.; T. A. Riehl, Goodyear Tire & Rubber Co.; and Harold Niemeyer, Firestone Tire & Rubber Co. Henry F. Palmer, Kentucky Synthetic Rubber Corp., acted as moderator.

The technical meeting was followed by a cocktail hour and dinner, which attracted 650 members and guests. The past chairman, D. F. Behney, Harwick Standard Chemical Co., on behalf of the executive board, presented a gavel to the current chairman, Lawrence M. Baker, General Tire.

The following nominations for offcers for 1953-54 were announced: chairman, R. H. Marston, Jr., Binney & Smith Co.; vice chairman, Mr. Brothers and V. L. Petersen, Goodyear; secretary, Andrew Tomlin, Monsanto Chemical Co., and F. W. Gage, Columbia-Southern Chemical Corp.; and treasurer, Harry Brubaker, Witco Chemical Co., and L. A. Anderson, Leverett A. Anderson Co.

Mr. Anderson, membership committee chairman, announced that the Akron Group now has a record membership of 1,502, a gain of 56 since last year. Foreign guests at the meeting were introduced, including the nine-man Norwegian MSA Productivity Team currently studying American rubber industry production. Cash door prizes, donated to the March of Dimes, were won by H. D. Harrington, General Tire, and C. B. Hudson, Akron Standard Mold Co.

The after-dinner speaker was James Schlemmer, sports editor of the *Akron Beacon Journal*, who talked on "The Sports Outlook." He was introduced by Henry M. Rose, H. Muehlstein & Co., program chairman. In his talk, Schlemmer drew on his experiences from many years of contact with the sports world and answered questions from the floor about Akron's favorite sports topic, the 1953 Cleveland Indians.

Symposium Questions and Answers

1. Q. What is the long-range outlook, price-wise, of GR-S and of natural rubber?

A. Palmer. Assuming money values approximate what they are today, it seems the opinion of many that the average type of GR-S will sell for no less than 25¢ and probably no more than 30¢ per pound under private industry operation. It is also likely that #3 smoked sheets will approximate this price on the average, with certain market fluctuations to be expected. Oil-extended synthetic rubbers will likely be 3-5¢ per pound cheaper.

2. Q. Are there any major plans for large size natural rubber planting in the Far East?

A. Palmer. Apparently most of the large estates are going ahead actively with substantial replanting programs, and the Natural Rubber Bureau has reported that Malayan smallholders have been embarking on a replanting program. There also appears to be a definite native replanting effort. For some years Malaya has been levying against all natural rubber exports and will start a program to plant a half million acres for benefit of the natives. Obviously the replanting which starts from now on is not going to have any effect on the supply until 1960 and later, but if there is reasonable political stability in the Far East, it is likely there will be a greater production expansion than many in the industry anticipate.

3. Q. At what price differential would GR-S replace crude (and to what extent) in passenger-tire carcasses?

A. Niemeyer. GR-S is almost the full equal of natural rubber in passenger-tire carcass performance, particularly in the large-volume small sizes. Hence GR-S would replace natural rubber when there is any economic advantage whatever.

A. Reahard. Even at a very substantial savings for GR-S, it would not replace natural rubber in large premium and first-quality line tires. In the smaller first-quality and second- and third-line passenger tires, GR-S would replace approximately 70% of the natural rubber in the carcass compounds when the price differential was 4-5¢ in favor of GR-S. In small first-quality and second- and third-line tires, the GR-S would replace all the natural rubber in passenger-tire carcass when the price differential was from 8-10¢ a pound in favor of GR-S.

A. Riehl. Crude natural rubber and GR-S both give equal performance when used in the carcass of passenger tires. Any conversion from GR-S to natural rubber would be influenced almost entirely by the economics of the change which would include such things as the relative cost of the two rubbers as well as processing factors involved.

4. Q. At what price diferential would crude natural rubber be used to replace GR-S in passenger-tire treads?

A. Niemeyer. In my opinion natural rubber would have to be considerably below GR-S to justify its use in passenger-tire treads because of the better tread wear and better resistance to tread cracking we now obtain with cold GR-S. It is difficult to set an exact price differential at which this change would be made as it will depend on the attitude of management, profit position on tires, and pressure from moves made by competition. We don't want to reduce the use of synthetic to the point where the government would step in and reestablish end-product specifications in an M-2 order.

A. Reahard. At a very substantial savings for natural rubber, it would not replace cold GR-S in premium or first-quality passenger tires. In second-line tires, natural rubber would probably replace GR-S when the price differential was 3-5¢ in favor of natural rubber.

A. Riehl. GR-S has firmly established itself as a material for use in passenger-tire treads on a quality basis. We do not feel that under the normal range of price levels we would now anticipate a shift from GR-S back to natural rubber in passenger-tire treads unless there is an industry move in this direction.

5. Q. At what price differential would cold GR-S be used to replace crude natural rubber in truck-tire treads, and in what sizes and types of truck tires?

A. Niemeyer. With sufficient economic advantage cold GR-S could be used in small truck tires possibly 7.50 and smaller.

A. Reahard. Small single-bead truck tires of first-quality line would be con-

sidered in the same category as premium and first-quality passenger tires as mentioned above.. Large single- and twin-bead highway truck tire treads through the 9.00 cross-section would be made from natural rubber until the price differential approached 10¢ a pound in favor of GR-S.

A. Riehl. GR-S and crude natural rubber are directly competitive in such truck tires as would be used in moderate to easy service. In this classification you might include all tires from sizes 7.50 and down, also such tires as are used on city buses, truck airwheels, and possibly some off-the-road tires in the smaller sizes. GR-S does not match natural rubber in quality and performance in large-size truck and inter-city bus tires, and, unless conditions of extreme shortage occurred, GR-S would not be used in this service under any foreseeable price differential at present.

6. Q. Assuming equal price and unlimited availability on GR-S and natural rubber, name the large-volume end-products in which GR-S would be preferred.

A. Reahard. The large-volume end-products where we would use GR-S in this case would be passenger and small truck-tread compounds, and passenger tire camelback. In mechanical goods, it would be used to a limited extent in extrusions where larger tolerances as to diameter and length of the finished extrusion are specified. The largest usage in mechanical goods, however, is in those products for the Armed Services where GR-S can be satisfactorily substituted for natural rubber.

7. Q. Generally what is the equivalent in cost between GR-S and natural rubber? If natural rubber cost 30¢ a pound, what is a good price for GR-S?

A. Hosier. To arrive at a general or mean price equivalent between GR-S and natural rubber would require the statistical evaluation of industry-wide data. Different companies would no doubt arrive at different values, depending upon the types of products produced, and different compounders would have different ideas, depending upon their own philosophies of compounding and the local factors influencing their compounding. In the field of black compounds and those non-black stocks heavily loaded with clays, there is as much variation in volume of loading within one type of elastomer as there is between the two types. Therefore in this field we might consider the cost of the basic polymers as about equal. The actual values would obviously depend on the grade of natural rubber involved.

In the field of non-black compounds, such as typical druggist sundries stocks it is necessary to use more expensive fillers with GR-S than with natural rubber. If the natural rubber is charged into such a stock at 30¢ a pound, a cold GR-S would need to be priced at 25¢, and a standard GR-S at 24¢ in order to obtain equal volume costs. This last 1¢ differential results from fact that ultra-fine fillers are necessary with the standard GR-S; while the cold GR-S yields good physicals with fillers of somewhat larger particle size than the ultra-fines.

8. Q. What are the relative wearing qualities of passenger tires made wholly from each of the following three compounds: 100% natural crude rubber; 100% GR-S; and a combination of GR-S and crude rubber, each being used to its best advantage whether for carcass or tread?

A. Reahard. The relative wearing qualities of passenger tires are given in the table which follows:

Polymer	Tread Wear %	Carcass Durability %
100% natural rubber	100	100
GR-S	120	75
Combination of natural and GR-S	120	100

The 100% GR-S values are based on the fact that cold GR-S treads give improved tread wear, but the carcass durability is reduced because of separation in the carcass or between tread and carcass where carcass compounds using 100% GR-S are involved. In the combination of a natural rubber carcass and a GR-S tread, it is possible to take advantage of the improved tread wear of cold GR-S and still maintain the good carcass durability of natural rubber.

9. Q. Very little trouble was ever encountered with natural-rubber tread splices. Please describe material and procedures to obtain a GR-S tread splice which will not be noticable after a tire has been in service for 5,000 miles. Describe materials and procedures to obtain sidewall splices which do not open in service.

A. Riehl. As long as the tubed tread and sidewall are properly handled and cemented, we do not feel that a GR-S tread or sidewall presents any greater problem relative to open splices than did a natural rubber tread and sidewall. Care must be given to see that the stocks are carefully plasticized and tubed to avoid excessive shrinking, and an ordinary natural rubber-carbon black cement should be used to give sufficient tack at the splice. The workman, in making a splice, should permit no overlapping; nor should he be required to put excessive tension on the tread or sidewall in order to make the actual union. The age of the treads, as well as their dryness, is always a factor, and should the treads be too old, recementing is often considered advisable.

10. Q. Is there a satisfactory all GR-S friction from the standpoint of frictioning and building "tack"? If so, what type?

A. Riehl. We know of no GR-S which will give satisfactory building tack. Koresin and Cumar resins in the GR-S will help some, and it also has been felt that rosin-acid GR-S may be somewhat better than fatty-acid GR-S, but our experience has not necessarily substantiated this point. A GR-S friction will take satisfactorily a hot GR-S coat on square-woven fabric. If the coat is to be put on cold, and the fabric is to be built into a tire or other article with only frictioning, then a rubber cement is necessary for tack.

11. Q. In the addition of Syncera wax to GR-S compounds for sunlight protection, how much is commonly used? How much wax on 100 GR-S is held in solution?

A. Riehl. The amount of wax used to give sunlight protection depends both on the type of GR-S and also on the ultimate service into which the article is to go. Hot GR-S was in itself fairly resistant to weather aging and did not require the protection that cold GR-S does. With cold GR-S ½-1 PHR of a microcrystalline wax is about all that is necessary to give the protection desired. Should the compound be used in such an article as a molded strip for a car, you might want to use as much as six parts of wax. The amount of wax held in solution in GR-S is dependent on the melting point of the wax, with the higher melting point wax showing less bloom. The amount actually held in solution is probably in the range of less than one PHR, for where we depended on the bloom for protection, we know this amount of Syncera wax will give protection.

12. Q. I am informed that cold GR-S shows better tread wear in the summer in comparison to natural rubber than it does in winter. Is this so and why? I am also advised that the reverse of this is true on truck tires under the same condition. If so, why?

A. Niemeyer. On passenger tires cold GR-S gives better tread wear than natural rubber in both summer and winter. However cold GR-S does show relatively greater superiority over natural for tread wear in summer than it does in winter. There is only a slight difference in the rate of tread wear for cold GR-S between summer and winter testing, but with natural rubber the rate of tread wear is significantly less in winter than it is in summer.

I do not agree with the statement on tread wear of truck tires. The same relation exists for them as for passenger tires.

In 1949-1950, project BCD on the RFC fleet gave a good picture of relative wear of synthetic and natural rubber on truck tires in summer and winter.

Cold GR-S gave a wear rating of 20% better than did natural rubber in the summer, but only 5% better than natural rubber in the winter.

13. Q. In compounding and subsequent tire building what progess has been made with special cements toward improved tire construction with oil-extended polymers?

A. Niemeyer. There has been very definite progress in developing special cements to improve adhesion in building tires with oil-extended polymers. There was some publicity last year on water-base latex-type adhesives containing resorcinol-formaldehyde resin. These appeared to give improved uncured adhesion over the conventional natural rubber-solvent cements in tire assembly, but it was diffcult to control and maintain adequate cured adhesion.

We have found it more satisfactory to stay with the solvent-type cements. However a conventional natural rubber stock-solvent cement was not adequate with oil-extended polymers, and it was necessary to make improvements in uncured tack by adding tackifiers. This increase overcame the poorer adhesive quality of the oil-extended polymer stock and gave good uncured adhesive strength at room temperature and also at the elevated temperatures encountered in bagging tires. Cured adhesive strength was also satisfactory.

14. Q. *(A).* What are the future prospects for oil-extended GR-S? *(B).* What are the future prospects for industry-wide acceptance of large-scale production of oil-extended GR-S? *(C).* Is there any particular field in which oil-extended GR-S is preferable to regular GR-S?

A. Niemeyer. *(A).* The future for oil-extended GR-S is definitely bright. It will be difficult to hold back its use because of its economic advantage when you can use a high percentage of 2-3¢/lb. oil and obtain performance results which are almost equal to 24¢/lb. GR-S polymer. There will be differences of opinion on the relative performance of oil-extended and regular cold GR-S. However, even if the oil-extended is slightly inferior, it will still move forward because of the economic advantage and the increased GR-S plant capacity realized.

(B). We already have evidence the industry will accept large-volume production of the oil-extended GR-S. In two years RFC production has grown from zero to 9,000 tons a month. This means approximately 35% of the present gross weight cold rubber production is oil extended. There was some hesitancy to expand its use rapidly since there was some uncer-

tainty as to what the effect of prolonged aging in the field would have on tire performance. It now appears there will be no pronounced deterioration, and further expanded use should be forthcoming.

(C). It would definitely be preferred in second-line tire treads and body plies where its lower cost is important; also in moderate and low-cost mechanicals where it will meet specification requirements. It should also be preferred in first-line passenger and small truck tires except possibly premium tires and the large-size passenger where greater demands for high-speed performance must be met.

15. Q. This question concerns the compounding of passenger-tire carcass compounds. In your opinion which of the following two methods will produce the better tire from a service viewpoint, cost eliminated from consideration: (1.) 50% total hydrocarbon from crude natural rubber, 50% whole tire reclaim; (2) 75% total hydrocarbon from GR-S, 25% whole tire reclaim?

A. Niemeyer. While I have no test results on direct comparisons of the two types of compounds presented, it would be my opinion the 75% GR-S with 25% whole tire reclaim would be the better of the two on which to base a passenger carcass compound. We know that at the same reclaim levels as used in natural rubber, 100% GR-S passenger carcass compounds will give entirely adequate service, particularly the smaller size large-volume passenger tires. With this thought in mind we would certainly prefer GR-S with 25% reclaim over natural rubber with 50% reclaim.

16. Q. What is that status at present and what are the prospects for GR-S (cold GR-S and/or oil enriched) in truck treads?

A. Riehl. Cold GR-S and oil-masterbatch GR-S rubbers can be used under moderate service conditions to give tread performance approaching that of natural rubber. However, under more severe operating conditions, GR-S has been found definitely inferior to natural rubber. Admittedly we will get better wear and less cracking from GR-S treads on the large-size truck tires than we did during World War II, but extensive government testing has recently shown that GR-S does not give good tire performance under severe operating conditions.

17. Q. In general molded goods applications, are there any products in which oil-extended GR-S stocks have not been satisfactory, but in which regular GR-S or natural rubber stocks were?

A. Brothers. Oil-extended GR-S polymers have been checked in practically all types of our production, and certain compounds are processing equally as well as the regular GR-S or natural rubber compounds. In our opinion the oil-extended GR-S polymers do affect adhesion. They tend to give poorer results as well as less consistent results. Physical properties are similar, but tensile usually is around 5-10% lower. Knitting or rubber-to-rubber adhesion seems poorer than with the other polymers. We have observed no tendency toward bleeding or staining. Our prime difficulty has been one of handling or processing. The oil-extended GR-S will not take pigment or pull together as a batch so easily as regular GR-S or natural rubber.

18. Q. Is oil masterbatching for natural rubber as effective as it is for GR-S? If not, will it present any special problems if oil-masterbatched GR-S is compounded with natural rubber stocks?

A. Riehl. Oil-masterbatch natural rubber has been made by coprecipitating the oil with latex. We have found no advantage in this method over a dry mix. Oil-masterbatch GR-S is made with a high Mooney GR-S that could not be processed without the oil being present. Therefore some question exists as to whether the oil in an oil-masterbatch GR-S is available for plastication when mixed into a natural rubber stock.

19. Q. What is the maximum level of oil that can be satitsfactorily used in oil-extended GR-S in average molded goods compounds?

A. Reahard. It has been our experience that its is possible to use almost as high oil loading on oil-extended GR-S as it is on regular GR-S. We have successfully written compounds with 50 parts of added oil on the 100 of the oil-extended GR-S. This condition means that the total oil on the polymer will run as high as 100-120 parts. The theory is that the oil included in the polymer takes the place of low molecular weight copolymer in regular GR-S, and its action is not comparable to an ordinary softener until after an amount has been added equivalent to the amount of low molecular weight material contained in ordinary GR-S.

20. Q. What technical considerations necessitate the array of GR-S polymers?

A. Palmer. Back in 1942 a formulation for GR-S was adopted so that its properties would be acceptable to the greatest possible number of different types of consumers. Over the years refinements in synthetic rubbers have been made so that now we have a variety of variables to be incorporated in different polymers to achieve various end-results. For example, use is made of various emulsifiers, stabilizers, carbon blacks and processing or extending oils used in masterbatches, and the relative amounts of monomers which are reacted. All these variables lead to the present array of GR-S polymers. At present approximately 80 different synthetic rubbers are currently in use. It would be to the interest of everyone, cost-wise, to aid in the simplification of this array of polymers, whether they are provided from government or privately owned facilities.

21. Q. What compounding ingredients will give the least stress relaxation in GR-S and in natural rubber? Do you know of literature references on compounding for better stress relation properties in GR-S and natural rubber?

A. Brothers. We feel oxidation has a marked effect on stress relaxation, especially at higher temperatures. Since GR-S oxidizes less than natural rubber, compounds made from this polymer should give less stress relaxation. Also at elevated temperatures, non-sulfur compounds should exhibit less stress relaxation. Following the same reasoning those practices that give low compression set should give the least stress relaxation. These practices would be tight cures, the use of large particle size carbon blacks such as MTF and SRF, and a reduction or elimination of pigments that deaden the compound, like brown substitute. To obtain greater stress relaxation the reverse of these principles should be followed.

In our work we have not been able to obtain too good a separation between stress-relaxation and compression set. Braendle and Weigand[1] reported that at room temperature and even slightly higher, GR-S relaxes more at low elongation than at higher elongation because of the lower hysteresis of GR-S at the higher elongation. GR-S also relaxes less than natural rubber.

Beatty and Juve reported some results on various polymers in INDIA RUBBER WORLD.[2] They report correlation between their method of measuring stress relaxation is just fair when compared with ASTM Compression Set, Method B, with, however, the same general trend in rating the compounds tested.

Dogadkin and Reznikowskii[3] report that relaxation is the result of a regrouping of structural elements of the molecular chains as accomplished by intermolecular forces and is not primarily a matter of pigment compounding.

Mooney, Wolstenholme, and Villars[4] report a theory attributing relaxation to rupture of secondary chemical bonds and crystal forces with longitudinal slippage of chain molecules.

22. Q. List the service factors which must be weighed in choosing between GR-S and natural rubber for end-products commonly used in the home.

A. Cook. There are two factors: (a) the purpose for which the product is to be used; and (b) the functional qualities from a manufacturing viewpoint.

GR-S should be considered in every case from a material cost basis provided the incurred costs either from the curing angle or from percentage of defectives do not prove higher than if natural rubber were used. GR-S would be the choice where the end-product is exposed to water or heat, and where age resistance is necessary.

End-products which come in contact with food or which must be more free from odor are improved when natural rubber is used. The improved hot and cold tear resistance of natural rubber is an important factor in many cases both in the end-product and from a manufacturing viewpoint.

There is no choice between GR-S or natural rubber when considering color possibilities or resistance to kitchen greases, oils, and cleaning solvents.

23. Q. Dynamically can GR-S stocks be made which will be equivalent to natural rubber in resiliency, spring rate, and efficiency?

A. Niemeyer. A GR-S stock can be made equivalent to a given rubber stock for resilience and efficiency when dealing with highly pigmented compounds, but you may have to sacrifice on other physical properties in the GR-S stock. For example, you may reduce pigment loading or use higher concentrations than normal of curing ingredients to obtain increased efficiency and resilience; but at the same time you may have to accept either poorer tear resistance, lower modulus, lower tensile, or poorer resistance to cutting and chipping. The application of the compound involved would have to be analyzed to be sure the resulting GR-S stock would be adequate for performance.

If moderately loaded or pure gum stocks are involved, it is probable that GR-S could not be made equivalent to rubber since inherently the GR-S polymer is less effcient and resilient than rubber. GR-S can be made to have approximately the same spring rate as natural rubber compounds. However, here again, you will have to sacrifice on other physical properties.

24. Q. Is cold GR-S or natural rubber preferred for compounding mechanical rubber goods with high proportions of reclaimed rubber?

A. Brothers. In mixtures containing high percentages of reclaimed rubber and low percentages of new polymer, natural rubber is preferred. In general, new hydro-

[1] *J. Applied Phys.*, Apr., 1944, p. 304.
[2] Feb., 1950, p. 537.
[3] *Rubber Chem. Tech.*, 24, 99 and 810 (1951).
[4] *J. Applied Phys.*, Apr., 1944, p. 324.

carbon is used in these cases to obtain just a little extra quality. When used for these purposes, natural rubber has more inherent quality in the gum or unpigmented state than cold GR-S, possesses better processing qualities with less nerve and more building tack, reinforces more in the uncured state, and can be used in lower percentages in the compound.

25. Q. Natural rubber has two properties that are difficult to obtain with GR-S: (1) tack or adhesive properties essential on calendered ply stock for ease in tire building; and (2) low hysteresis. What are the prospects for improving GR-S in these two essentials?

A. Riehl. We know of no GR-S type of compound that will materially improve the tack or adhesive properties necessary for good tire building and still maintain satisfactory cured properties. If it is not possible or feasible to incorporate 20% or more natural rubber as the hydrocarbon, then you must resort to a post-calender natural rubber cement.

The higher Mooney GR-S rubbers now being produced are coming closer to approaching the low hysteresis found in natural rubber. To process these rubbers, however, we must resort to the oil masterbatch, and it is here that we anticipate producing a practical low hysteresis-type GR-S.

26. Q. Can you give a rough relative rating of cold GR-S and natural rubber with respect to dynamic properties?

A. Reahard. In many respects the dynamic characteristics of cold GR-S are similar to those of natural rubber. In actual applications it has been found that properly compounded cold GR-S can be substituted for natural rubber in such applications as bumpers or mountings. In other applications where there is an internal working of the part under load, such as in shock absorber bushings or Silentbloc mountings, GR-S cannot be substituted 100% for natural rubber. Even in these applications, large percentages of GR-S can be used. It appears that the theoretical limit in this type of application is a 50-50 blend. If the GR-S predominates, the part will fail as quickly as if it had been fabricated entirely from GR-S.

27. Q. Can GR-S stocks be produced that will have as high dielectric strength as natural rubber stocks?

A. Niemeyer. My answer would be yes. I assume the low water soluble types of GR-S would be used, and moderately high pigment loading would be present. If a lightly loaded or pure gum stock were involved, I would think that natural rubber would have an advantage, and it would be difficult to produce a similar GR-S stock with as high a dielectric strength.

28. Q. Discuss effects of hot *versus* cold milling on GR-S and natural rubber stocks.

A. Cook. In discussing this question, I would like to refer to the work done by Busse and Cunningham on the breakdown of natural rubber. They proved by the different results of breaking down natural rubber in the presence of nitrogen, oxygen, and ozonized oxygen that mastication of rubber was an oxidation reaction, also that the greatest effect on plasticity was at temperatures of 300 to 380° F. Their work showed only a mechanical breakdown of natural rubber at milling temperatures of 120-180° F. and very little, if any, breakdown at temperatures of 200-280° F.

Hot GR-S will follow just about the same curve as natural rubber. However mechanical breakdown of cold GR-S has little or no effect on the plasticity, and high temperatures actually toughen up this polymer.

29. Q. Why is non-staining cold GR-S hotter in the Banbury during mixing than is staining cold GR-S?

A. Riehl. Our experience in this matter shows that there is no difference in the temperature of the Banbury during mixing. In this comparison we have used GR-S 1502 *vs.* GR-S 1500. We have also made the comparison of 1502 against X-626, and in each of these instances we found the non-staining GR-S to mix at about the same temperature as the staining GR-S. Another non-staining cold GR-S is available, 1503, which uses Polygard as its antioxidant. Polygard does not offer any plastication during the breakdown as do Wingstay and PBNA, and it may be that 1503 would tend to run a little hotter during mixing.

30. Q. Do synthetic detergents, now extensively used in the home laundry, affect natural rubber parts (for example, wringer rolls, gaskets, and other washing machine parts) more than those made from GR-S?

A. Rehard. The answer to this question is yes and no. We have run extensive tests on the resistance of various polymers to synthetic detergents. We find that regular GR-S is less resistant to the action of synthetic detergents than a high grade of natural rubber. We find that water resistant grades of GR-S, such as GR-S 1007 (or GR-S 65), are more resistant to synthetic detergents than high-grade natural rubber. We believe that this effect is proportional to the swelling characteristics of the polymers in water. Mixtures of polymers ordinarily show resistances in between those of the two polymers being blended. As far as actual resistance to detergents is concerned, there does not seem to be much difference in the various polymers.

31. Q. Discuss comparative sunlight resistance of GR-S *versus* natural rubber.

A. Hosier. This subject has so many ramifications as to render any detailed discussion here quite hopeless. While the deleterious effects of sunlight on rubber products have been well known for a long time, it is only in the last few years that we have begun to acquire an appreciation of the very many variables involved. The generalities expressed here in comparing GR-S and natural rubber are subject to many exceptions and contradictions.

Unstretched natural rubber compounds are subject to light-energized oxidation which produces a crazed appearance of a network of fine checks in a resinous or varnish-like layer. GR-S exhibits a similar reaction, but the surface layer usually appears drier, harder, and less continuous in structure. The condition referred to loosely as "frosting," encountered in pure gum and non-black rubber stocks exposed to light, and particularly under conditions of higher than normal humidities, is commonly encountered with natural rubber, but is very much less evident in GR-S stocks. Non-black GR-S compounds mold with a smoother and more glossy surface than does natural rubber and retain this surface without clouding or dulling very much longer. This condition may be partly attributable to the finer particle size of the fillers usually used and the presence of relatively high percentages of paracoumarone resins necessary to obtain good physicals, but seems mainly due to the inherent characteristics of the synthetic polymer, as compared with the natural.

The cracking of rubber exposed under strain is due to ozone. Early experience indicated that GR-S was inferior to natural rubber in this respect, and this point is no doubt true of compounds not specifically compounded for weather resistance. However, when compounds are properly designed for weathering protection, there seems little difference between the two polymers. Methods now in use for securing such protection are largely palliative and not too satisfactory.

32. Q. Discuss types of acceleration for GR-S and natural rubber.

A. Brothers. This particular question could be discussed *pro* and *con* for the remainder of the afternoon. In general, the same practice in regard to acceleration is followed with both natural rubber and GR-S. Standard practice calls for a higher percentage of acceleration and a lower percentage of sulfur with GR-S than with natural rubber. A greater leeway is allowed for combined sulfur with GR-S. The thiazoles are the prime types used for general-purpose compounding with both polymers. Secondary accelerators are also much the same, with one notable exception. The copper bearing types of secondary accelerators can be used with more safety with GR-S than with natural rubber.

By proper combinations GR-S can be made to cure as fast as natural rubber, but a higher percentage of acceleration is required for the same effect.

Our experience has taught us that we cannot use the substituted thiuram sulfides as prime accelerators in extremely thick pieces. These tend to set up too rapidly; here the difficulty encountered is one of cooling rather than curing. We use slower accelerators in such applications. These are used, however, with both polymers for sulfurless cures.

A low percentage of sulfur for vulcanization with tetramethyl thiuram disulfide improves tensile strength and elongation in GR-S as in natural rubber. Low sulfur mixes containing selenium give intermediate results; age stiffening is generally least with the low sulfur and selenium and greatest with tetramethyl thiuram disulfide. Thiazoles give better results than the thiurams in mixes with the same sulfur ratio.

In general, natural rubber compounds are more susceptible to variations in compounding than are GR-S compounds. It seems that greater variations can be tolerated by GR-S than by natural rubber.

33. Q. Does Banbury breakdown have much effect on plasticity of GR-S without peptizers?

A. Cook. Banbury breakdown of hot GR-S without peptizers does have an effect on the plasticity of the polymer. Banbury breakdown is more effective in the higher temperature ranges. The plasticity of broken-down hot GR-S will hold fairly constant. Banbury breakdown of cold GR-S has little or no effect on its plasticity. Therefore most of the cold GR-S is used directly without any breakdown.

34. Q. *(A)*. In high-grade hard rubber compounding, does GR-S or natural rubber have the faster rate of cure based on thicknesses of ⅛- to ¾-inch? *(B)*. Does the degree of plasticization of GR-S or natural rubber affect the ability of either to carry physicals in hard rubber? If so, which is better?

A. Hosier. *(A)*. With proper acceleration it is possible to produce GR-S compounds which will vulcanize in the same time as natural rubber. As a matter of fact, we have seen accelerated and loaded GR-S compounds, in relatively thin sections, set up in a mold and hard-cured in open steam which permitted a very rapid rise in steam pressure and a shorter hard-cure cycle than corresponding compounds made from natural rubber.

With high-grade hard rubber in relatively thick sections acceleration usually is held to a minimum to avoid porosity. The exothermic reactions involved in curing thick sections are much more pronounced

in GR-S than in natural rubber, and to prevent porosity it is advisable to employ lower curing temperatures. The net result is that, from a practical standpoint, GR-S must be considered as slower curing than natural rubber, under these conditions.

(B). Normal variations in the plasticization of either GR-S or natural rubber apparently have no appreciable affect on the rate of vulcanization or the ability of either to carry physicals in hard rubber. Abnormal mastication of natural rubber (say a couple of hours) does result in some reduction of physicals, and excessive mastication after compounding is more harmful on GR-S than on natural rubber alone. Overmilling of GR-S in most any type of compound does not reduce cured physicals nearly so much as with natural rubber, and in the case of hard rubber the effect is practically nil. In either case such extreme mastication is unlikely to be encountered, and the effect of mastication on the physicals may be disregarded. A word of caution should probably be inserted on the use of oils and softeners. They are often used in small amounts as processing aids, but in large quantities they may seriously affect physicals. There are no general rules; different softeners affect different physical properties, and there seems to be little or no correlation between GR-S and natural rubber as to the resultant effects.

35. Q. Which makes better lasting road surfaces when mixed with asphalt —GR-S or natural rubber?

A. Riehl. Considerable work is being done in an attempt to answer this question. At present it is not possible to give a definitive answer on the basis of results to date. We believe that in the long run, GR-S will have certain advantages, particularly in that it can be custom made for the job required of it. Furthermore GR-S is less expensive, which point is quite a factor in this problem.

36. Q. Can a light-colored GR-S stock be compounded of about 65 durometer that will compare with a natural rubber light-colored stock of 65 durometer for bonding to steel?

A. Brothers. Light-colored 65 durometer GR-S stocks can be bonded to steel as readily as light-colored natural rubber stocks. However, when the adhesion is checked, it should always be better than the rupture strength of the compound itself. It is recognized that light-colored stocks can be produced to higher quality by using natural rubber than with GR-S, and it would follow that higher-quality adhesion stocks can be obtained in light-colored natural rubber compounds.

37. Q. In the manufacture of gloves, balloons, and similar dipped goods, is there any type of GR-S that could be used competitively quality-wise with natural rubber?

A. Hosier. The phrase "competitively quality-wise" makes the answer to this one definitely "No." The relatively poor film-forming characteristics and the extremely low pure gum physicals make GR-S latices quite unsuitable for high-quality dipped goods. In a competitively priced glove with no serious demands for quality it is possible to blend small percentages of GR-S latex, but the quality very definitely suffers. Replacement of 25% of the natural rubber in a latex compound by GR-S lowers the tensiles by as much as 50%. Such replacements using cold latices produce decreases in physicals of a somewhat lower order, but reproduction of consistent results is difficult due to a lack of uniformity in the synthetic latices. The cold types point the way toward possible improvement, but are still a long way from *Hevea*.

38. Q. Explain the relative behavior of GR-S and natural rubber under conditions of high temperature and long aging.

A. Brothers. We normally interpret this behavior of both GR-S and natural rubber as one of oxygen adsorption. The rate of oxygen adsorption will increase as the temperature is increased. Cross-linking of the polymer appears more rapidly with the GR-S polymer than with natural rubber when exposed to heat aging. When GR-S is oxidized at high temperature over a long period of time, the oxidation will reflect itself both in a loss of strength as well as in an increased stiffness of the compound. We suspect that this stiffness can be caused by the oxygen bridging or cross-linking.

Depending upon time and temperature the reverse can also be observed where an increase in oxygen concentration can cause a softening action rather than a stiffening action.

Natural rubber seems to move in the direction of softening when exposed to high temperature over a period of time. The tighter the cure for the GR-S, the less susceptible it is to the softening reaction. GR-S vulcanizates seem to reach a constant strength value, but do become stiffer and less extensible. In hot service conditions the GR-S will tend to fail owing to its inability to stretch rather than through loss in strength.

Our experience indicates that GR-S compounds will resist these higher temperatures and longer aging periods better than natural rubber, and we are inclined to believe that current reclaiming techniques tend to prove this out. Results from our laboratory show that GR-S exposed for seven days at 158° F. will show a maximum loss in the range of 2% when judged by tensile strength. Those results will vary from the maximum loss of 2% to a positive increase in strength, depending upon state of cure. When these same compounds are exposed to 212° F for a period of four days, they will lose tensile strength in the range of 10-12%.

Under identical test conditions, natural rubber compounds will lose in the range of 10-15% in tensile when exposed to the seven-day test at 158° F. When the compounds are exposed to 212° F. for four days, the loss in tensile can be as much as 80%.

Holt on Trends in International Rubber Trade

EVERETT G. HOLT, specialist on rubber in international affairs, Rubber Division, National Production Authority, addressed a joint meeting of the American Marketing Association, Akron Chapter, and the Sales Executive Club of Akron, at the University Club in Akron, O., on March 3. He discussed "Trends in the International Trade in Rubber."

Holt first mentioned the increase in exports of rubber goods between 1921 and 1929 when the dollar value rose from $30 million to $76 million. He pointed out that with this increase foreign countries imposed barriers to such imports, and the United States manufacturers established branch factories in foreign countries to service these foreign markets. Imposition of exchange controls and restrictions on remittances in many cases today prevent or seriously hamper not only the repatriation of capital originally invested, but even the return to the United States of annual profits on the investment, it was said.

Holt then reviewed the Stevenson Rubber Restriction Scheme of 1922-28 and the similar International Rubber Regulation Agreement of 1934 and explained how the temporary benefits of these schemes eventually resulted in the developments which reduced both the market and the price for natural rubber in the United States.

The general postwar situation in the world rubber industry *with respect to rubber materials* was summarized as follows:

1. The production of natural rubber has not been great enough to equal the consumption of new rubber; so the use of synthetic rubber to make up the deficit has been an economic necessity.

2. Establishment of strategic stockpiles of natural rubber by the United States and other countries reduced the supply of natural rubber and increased the demand for synthetic rubber.

3. Foreign countries using mainly natural rubber outbid the United States since their requirements are smaller.

4. The United States can therefore import only the residue of natural rubber production minus foreign demand, and the industry can buy only the residue left over after stockpiling.

5. The industry has bought this residue and used it and used as much additional synthetic rubber as necessary to meet the demand for consumption in this country.

6. Since the end of World War II the use of natural rubber in foreign countries has shown a rising trend and is now approaching 1,100,000 tons.

7. World production of 1,762,000 tons of natural rubber in 1952 is not likely to increase much, and the residue after foreign demand will probably become smaller.

It is obvious, therefore, that the United States industry does not possess unlimited freedom of choice in its use of rubber materials.

In trying to determine the relative supply of natural rubber and demand for GR-S, the industry has apparently had a tendency to rely on the *price* of natural rubber too much, Holt declared. A better guide to near future availability is world stocks of natural rubber. Stocks of GR-S should be increased when GR-S and natural rubber production is declining, and the responsibility for stock carrying should be a joint responsibility of government and industry, even if the GR-S plants are sold to private industry.

Commenting on the recent efforts of the Working Party of the International Rubber Study Group to devise a practical buffer stock agreement for natural rubber, Holt mentioned London press reports that indicated acceptance of the decisive role to be played by the future price of synthetic rubber on natural rubber trade, whether free or controlled by buffer stock agreements.

With reference to the recent Ceylon barter of rubber for rice from China, it was pointed out that Ceylon now has to reduce purchases of products from the United States and the United Kingdom because of reduced dollars and pounds sterling.

In conclusion, Holt mentioned that the rubber industry in the United States has been under government control for so long that added responsibility is placed on the younger generation of rubber executives who have never had to operate in an atmosphere of more or less complete freedom from regulation.

Review Recent New Polymers

THE winter meeting of the Connecticut Rubber Group attracted an attendance of 92 members and guests at the Hotel Barnum, Bridgeport, Conn., on February 20. The program included a cocktail hour, dinner, technical meeting, and business session. Feature of the meeting was a talk on "Elastomers of the Future," by Gerald W. Kuckro, General Electric Co. There was also a showing of a film on duck hunting, entitled "Gunning the Fairways," presented through the courtesy of Remington Arms Co.

Mr. Kuckro briefly described the properties and potentials of six selected elastomers that are expected to come into considerably wider usage within the next five years. These materials are the acrylic elastomers, Alfin polymers, Hypalon S-2, redox polymerized elastomers, sodium elastomers, and Vulcollan.

The rubber industry is chiefly concerned with the more rubbery polyesters of acrylic acid. Ethyl acrylate is copolymerized in emulsion form with small amounts of chloroethyl vinyl ether to yield an elastomer that can be processed in standard rubber machinery. Sulfur and fatty acid are required for vulcanization, and triethyltrimethyl triamine is the most potent accelerator known to date. Although inferior to the silicone rubbers in heat resistance, acrylic rubbers are vastly superior to nitrile rubbers in this respect. Other outstanding properties of the acrylics include resistance to ozone, oils, sunlight, oxygen, cut growth, and flexing.

Alfin catalysts are special sodium salt combinations which cause rapid catalytic polymerization of butadiene to high molecular weight polymers generally gel-free. The catalyst is usually a mixture of allyl sodium, sodium isopropoxide, and sodium chloride. Alfin rubber is extremely tough and does not break down upon milling. Alfin polymers yield higher tensiles, flex resistance, and abrasion resistance than their emulsion analogs.

Hypalon S-2, du Pont's chlorosulfonated polyethylene, can be vulcanized with metallic oxides, sulfur-type accelerators, and organic acids, and processed in standard rubber equipment. Vulcanizates show complete resistance to ozone; excellent resistance to abrasion, heat, and weathering; very good flex life and crack growth resistance; moderately low water absorption; and high hysteresis. Hypalon's electrical properties are between those of neoprene and natural rubber and permit its use only in low-voltage applications.

Redox polymerized elastomers are made possible by three classes of low-temperature activators: diazothioethers, hydroperoxide iron types, and polyamines. Hydroperoxide polyamine, used in the last-named system, is of greatest interest because it reduces the metallic content of the finished polymer, giving non-staining and non-discoloring properties. Many improvements have been effected by RFC, chief of which is the use of cumene hydroperoxide as the oxidizing agent. A substantially iron-free system is achieved by use of cumene hydroperoxide and tetraethylene pentamine.

Sodium elastomers are of interest because of their history, method of manufacture, and properties. Large amounts of an interesting copolymer, designated S-BS, were made in Germany during the war. This copolymer was equivalent to natural rubber and superior to GR-S in processability. Tensile, elongation, aging, and abrasion were equal to those of GR-S; low temperature embrittlement was inferior to that of GR-S; and flex cracking and hysteresis properties were far superior to those of GR-S.

Vulcollan is a development from the original "I" (isocyanate) rubber made by Pinten in Germany. The preparation of Vulcollan consists of the formation of the linear polyester, increasing the chain length of the polyester, and the formation of a urea through cross-linkage with water to develop a network structure. Products thus obtained have unusually high tensile strength, excellent abrasion resistance without carbon black, and very good tear resistance. The aging of Vulcollan is outstanding, and, owing to the absence of oxidizable double bonds, sensitivity to ozone and oxygen is completely lacking. Processing and other technical difficulties are still to be improved with this rubber, the speaker concluded.

Hypalon Topic at Ontario

THE February 11 dinner-meeting of the Ontario Rubber Section, C.I.C., was held at Hart House, University of Toronto, Toronto, Ont., Canada. Inclement weather restricted the attedance to 43 members and guests at dinner, and 60 at the technical session which followed. Speaker of the evening was W. J. Remington, E. I. du Pont de Nemours & Co., Inc., who discussed "Hypalon—Chlorosulfonated Polyethylene."

Mr. Remington noted that Hypalon is the outgrowth of a new concept in elastomer technology: that satisfactory elastomers can be developed from chemically saturated materials. Hpyalon vulcanizates cured with either litharge or magnesia have shown outstanding resistance to concentrated acids and alkalies. This inertness is accompanied by resistance to degradation at elevated temperatures, and complete resistance to ozone.

Hypalon is compatible with other common elastomers, and these blends have proven useful for many commercial applications. For example, white and light-colored blends with natural rubber or GR-S have been successful in tire sidewalls, hose and wire jackets, and boot stocks, the speaker declared. Hypalon increases the modulus of butyl rubber about four times when added at a level of only 10%, and a 50% blend with nitrile rubber shows good resistance to both oils and ozone. Commercial applications for Hypalon take advantage of its durability and include acid handling, mine, and garden hose; and solution coatings for rubber floor mats, auto window stripping, toys, and conveyor belts. Other applications under active development include footwear finishes for gloss and ozone protection; coatings for Orlon and cotton awnings, convertible tops, and upholstery material; weather resistant sponge for cushions and pads; refrigerator gaskets; tire curing bags; and tank linings.

Lignin-Rubber Combinations

The March 10 dinner-meeting of the Ontario Section was also held at Hart House. The 33 persons present heard G. C. Maassen, R. T. Vanderbilt Co., Inc., East Norwalk, Conn., speak on "Accelerator System for Lignin-Natural Rubber Combinations."

Mr. Maassen stated that the use of lignin to reinforce elastomeric polymers and to improve the scorch, aging, and cost properties of the polymers requires that the lignin be coprecipitated with the latex. Lignin-GR-S latex combinations can be made and vulcanized with the ordinary GR-S vulcanization systems, using the same quantities of accelerators as is therein normally employed. Best results were obtained by use of sulfur, thiazoles, and dithiocarbamates accelerators activated by substantial quantities of metallic oxides such as lead, copper, and bismuth.

On the other hand, vulcanization of the coprecipitates of lignin with natural rubber latex requires the use of greater amounts of the accelerator than are employed in the usual natural rubber process. Mr. Maassen cited, in this respect, that sulfur, Altax, Tuads, and Bismates have been successfully used as accelerators to retain the desirable features imparted to polymers by use of lignin.

New Tire Tester Described

A DISCUSSION of a new tire testing machine by three speakers from the National Bureau of Standards featured the February 18 meeting of the Washington Rubber Group, held at the Pepco Auditorium, Washington, D. C. Gerald Reinsmith discussed Army Ordnance's need of a new tester; Robert D. Stiehler described the design features of the new machine, and Andrew P. Gregg spoke on the engineering features of the new tester.

Mr. Reinsmith said that tires purchased for the Armed Services are maintained at a certain quality level by means of specification requirements calling for both laboratory and road tests. Since this method of testing is both expensive and time consuming, the Bureau of Standards has been working on the development of a new tester which would give results combining those now obtained from tire wheel testing and road fleet testing.

Dr. Stiehler stated that in the designing of the new tester, the principal considerations regarding the size of the track were to make it as large as possible to reduce the effect of track curvature on the test tires, and to keep the track within practical size limitations for housing. Present types of commercial tire wheel testers are so small that the tire meets a convex surface which increases its deflection. The track of the new tester is one-sixtieth of a mile in circumference, is made in three sections each weighing 6,000 pounds, and will accommodate 18 tires simultaneously. The track can be rotated at speeds ranging from 22-66 miles per hour. Abrasive dust, such as hydrated alumina particles, are used to keep the abraded rubber from gumming up the roadway surface and also to accelerate tire wear.

Mr. Gregg described the actual engineering details of the new tire tester, including the six hydraulic lifts to raise and lower the platform upon which the tires are mounted; the track roadway and drive; the guide wheels; method of tire mounting; temperature controls that can be regulated from —65 to +165° F.; tester ventilation; and the means for filtering the air in the tester housing.

Gates Club Meets

THE February meeting of the Technical Club of the Gates Rubber Co., Denver, Colo., featured a demonstration-lecture on the broad fundamentals of television by Lloyd B. Dodds, information supervisor of Mountain State Telephone & Telegraph Co. The transmission and reception phases of this medium of communication were discussed, and questions from the floor were answered by the speaker.

Wheel Braking Buffalo Topic

FORTY members and guests attended the March 3 meeting of the Buffalo Rubber Group at the Hotel Westbrook, Buffalo, N. Y. The afternoon technical session featured a talk on "Rolling Wheels Gather No Skids" by Alfred C. Gunsaulus, Goodyear Aircraft Corp. This session was followed by a cocktail hour and dinner, and the after-dinner speaker was James Daley, Department of Internal Revenue, who discussed the personal income tax.

Mr. Gunsaulus' talk described experimental work done on individual brake control to equalize braking of motor vehicles and thereby prevent skids and ineffectual steering. Presently available methods of brake control are frequently inadequate on slippery roads, since overbraking causes locked wheels and skidding. Since all the wheels on a vehicle do not contact the same spot of the road surface at the same time, and since each brake and brake drum does not always react in exactly the same manner, it is apparent that each wheel should have its own control.

Such a brake control system was devised for airplanes to prevent locked wheel skids. Tests of this system were made on ground vehicles, and the test results effectively demonstrated the advantages of individual brake control. Both the control mechanism and the test results were discussed in detail by the speaker.

Tire Talk at SAE Meeting

A PAPER on "Tire Safety at High Speeds" was presented by J. J. Robson, Firestone Tire & Rubber Co., Akron, O., at the National Passenger Car, Body & Materials Meeting of the Society of Automotive Engineers, Sheraton-Cadillac Hotel, Detroit, Mich., March 3-5. The greatly increasing horsepower capacity of automobiles in all weight ranges has presented tire manufacturers with new blowout and stability and handling problems. Mr. Robson stated that although the industry does not advocate high-speed driving, his company has done much toward solving the difficulties accompanying these high rates of speed.

Safety protection against blowouts was discussed at length. The primary problem in this respect is the thermal behavior of tires at speeds in the vicinity of 100 mph. It was found that the temperature of both the tread and the contained air increases very rapidly in the first two or three minutes and levels off at its maximum temperature of approximately 280 and 240° F., respectively, after approximately 10 minutes of travel time. (Lower speeds generate proportionately less heat over a greater period of time.) Since rubber is vulcanized at temperatures in the vicinity of 280° F., the converse process of devulcanization, with the corresponding loss of strength and adhesion, may also occur.

But the major problem which arises because of the extremely rapid heat development and the magnitude of the temperatures involved is the phenomenon known as traction waves. This is a distortion of the tread and body which first becomes apparent at speeds of 100 mph. and which increases in intensity as the speed increases. Unusual flexibility and severe stresses in the tread area of the tire, which result from these distortions, aggravate localized hot spots in the tread region and create high shear forces between the tread and the body of the tire.

Improvement of the tires should be possible, therefore, by reducing the traction wave and increasing the adhesion between tread and body. Steps have been taken in this respect in the material makeup of the tire to improve its heat resistance by special compounding of tread and body stocks and by use of synthetic rubber treads. The bond between the components has been strengthened by using new types of rubber compounds and improved fabric dips which bond the individual body cord to the surrounding rubber.

The addition of 4-6 pounds air pressure to conventional tires improves their safety performance at high speeds by causing a reduction in the temperature and the traction wave motion. Mr. Robson also stated in this respect that a break-in period for brand-new tires is advisable to permit equalization of the stresses within a tire and to permit the tire to gain its initial growth before being driven at top speed. The attainment of high speeds through a stepwise process of operating for a short time at moderate speeds was also suggested to permit equilibrium between the contained air and tread temperatures to be realized.

Mr. Robson concluded his address by stating that the problem of providing adequate stability and handling response has been studied, and, when it is considered that good stability and comfortable riding are not compatible, much real progress has been made in the field of high-speed handling.

Symposium on Molded Goods to Feature ASME Meeting

THE Rubber & Plastics Division of the American Society of Mechanical Engineers will meet at the Deshler-Wallick Hotel, Columbus, O., April 28 and 29, as part of the meeting of the parent Society. The Division meeting will consist of three half-day technical sessions, one of which will feature a symposium on industrial rubber molded products.

The rubber symposium will feature three papers as follows: "Progress in Manufacturing Methods in the Molded Rubber Products Industry," by J. H. Gerstenmaier, manager, development department, Goodyear Tire & Rubber Co., St. Marys, O.; "Product and Mold Design for Lower Ultimate Cost" by John K. Mason, manager, sales engineering, Firestone Industrial Products Co., Noblesville, Ind., and "New Products Engineering," by Howard H. Armstrong, design engineer, mechanical molded products division, the B. F. Goodrich Co., Okron, O. A fourth paper "Mechanical Properties of High Mooney Elastomers," by Merle Sanger and Paul Earley, the General Tire & Rubber Co., Akron, O., will also be presented at this session to be held on Wednesday morning, April 29.

The other two sessions devoted to plastics will be held on the morning and the afternoon of April 28. The morning session program includes the following papers: "Teflon—Its Properties and Uses," by L. W. Cornell, Minnesota Mining & Mfg. Co., St. Paul, Minn.; "Unplasticized Polyvinyl Chloride—The Dawn of a New Era in Corrosion Protection," by George S. Laaff, Bolta Co., Lawrence, Mass., and "Metal-Clad Laminates Used in Printed Circuitry," by Norman A. Skow, Synthane Corp., Oaks, Pa.

The afternoon program consists of the following additional papers on plastics: "Reinforced Plastics Connector Rings and Bolts for Fastening Timbers," by H. A. Perry, Jr., Naval Ordinance Laboratory, Silver Springs, Md.; "Reinforced Plastic Laminates for Aircraft Use," by Capt. D. Rossato, Wright Air Development Center, Dayton, O.; and "The Navy Looks at Structural Plastics," by W. H. Graver, Bureau of Ships, Washington, D. C.

Chairmen and vice chairmen for the various sessions will be: William Hedges, Columbus Coated Fabrics; Charles M. Fields, Shellmar Products; Robert I. Lainginger, and Stephen Palinchak, both of Battelle Memorial Institute; Steward Brams, Dayton Chemical Products; and C. B. Jones, Structurlite Plastics Corp.

The Society and the Rubber & Plastics Division invite all interested technical persons to attend this meeting. No charge is made to ASME members, but a $5 registration fee is charged to non-members. Chairman of the Rubber & Plastics Division is M. E. Lerner, *Rubber Age*, and secretary is Allen Gifford, Lord Mfg. Co.

New TLARGI Rubber Course

AN ADDITIONAL course in Basic Rubber Technology II is being given under the sponsorship of The Los Angeles Rubber Group, Inc. According to C. M. Churchill, Kirkhill Rubber Co. and chairman of the Group's educational committee, the new course is designed to provide instruction in rubber technology, production, supervisory duties, sales, personnel, and administration work. The course consists of three-hour sessions each Thursday evening, starting February 26, at the University of Southern California, and two field trips. Subjects to be covered include natural and synthetic rubbers, testing procedures, compounding and processing, quality control, heat transfer and vulcanization, and mold design.

Migration and Bloom Prevention

THE Kenrich Corp., Maspeth 18, N. Y., has announced that prevention of bloom and migration, and reduction of the amount of exudation in vinyl and rubber compounds are possible by the use of Kenflex plasticizers and processing aids. These resins have been reportedly confirmed by users as efficient coupling agents or mutual solvents and, as such, also permit the use of less compatible extenders, reduce the loss of volatile ingredients, and simplify incorporation of other polymeric plasticizers.

Expanded Vinyls

(Continued from page 70)

After describing the methods of molding vinyl sponge products, the speaker noted that a wide range of density, hardness, and other properties can be obtained in the finished product by variations in compounding. Typical commercial and experimental applications were discussed, and many samples shown. These uses include sound insulation, cushioning, marine floats, and thermal insulation for exposure clothing, boots, and helmets. The talk was followed by a spirited question-and-answer period.

NEWS of the MONTH

The report of the Reconstruction Finance Corp. to the President and the Congress on synthetic rubber plant disposal was made public March 2 and generally was received with approval by the Congress and the industry. A six-point disposal plan was proposed which appeared to be a reasonable framework for the final plan. It was emphasized that national security was no longer a bar to the transfer of the plants to private ownership as it was in 1950, but rather should require such action.

In Congress Senator John W. Bricker (Rep., Ohio) and Rep. Paul W. Shafer, (Rep., Mich.), both of whom are almost certain to assume a major role in shaping the government's policy and program for disposal, were reasonably well satisfied with the RFC plan. Sen. Bricker said that he thought "On the whole, the plan is sound," and Rep. Shafer stated that "all told, I think the RFC report can, without question, be used as a reasonable framework for legislation for disposal of our synthetic rubber facilities."

On March 20, a bill introduced by Senators Capehart and Bush granting a 90-day extension to the President from April 15 to July 15, for submitting his report threatened to prevent disposal legislation being presented before this session of Congress but a reduction of this extension to 30-days was worked out with Sen. Bricker.

State Department officials met in March and in early April with their Rubber Industry Advisory Committee in connection with the "buffer stock" agreement to be discussed at the May meeting in Copenhagen, Denmark, of the International Rubber Study Group.

The quantity discount limit rule on manufacturers' sales of replacement tires and tubes of the Federal Trade Commission is open to fresh speculation by virtue of the change in the make of the Commission which now has a majority inclined towards a less drastic rule than that announced in January 1952.

The Natural Rubber Bureau has suggested an international conference on natural rubber quality.

Washington Report by Arthur J. Kraft

RFC Proposes Six-Point Synthetic Plant Disposal Plan

RFC, through Administrator Harry A. McDonald, on March 1 submitted to the President and the Congress its report, "Program for Disposal to Private Industry of Government-Owned Rubber-Producing Facilities." The report included a six-point plan for disposal, the salient features of which were that no plant shall be disposed of until the pattern of disposal can be seen in its entirety, and that no individual plant dispositions shall take place except as a part of the whole program. Also, no final commitments for disposal shall be made by the government until after Congress examines the program as a whole. Detailed criteria on such things as industry structure and price are not included, since "the most difficult and controversial problems do not lend themselves to ready-made doctrinaire answers," it was said.

In his letter of transmittal McDonald stated that early in 1952 the withdrawal of the government from the field of synthetic rubber production finally seemed possible, and Morton E. Yohalem was designated to work out a disposal program. Mention was also made of conferences with the RFC's Rubber Advisory Committee and its Rubber and Petrochemical Subcommittees on Disposal and the suggested disposal plan submitted by the Rubber Subcommittee[1] and of views tendered by individual companies.

The report is made up of four chapters as follows: Introduction and Summary; National Security in Rubber; Fashioning a Competitive Industry: Disposal Plan; and Research Activities. Appendices comprise Data on Production and Consumption; Financial Data; and Summary Description of Facilities in the Government Synthetic Rubber Program. A Bibliography of Official Publications is also included, and the report runs for a total of 61 pages.

Possibly the two most important parts of the report are the Summary and Conclusions and the Plan, itself, and these are therefore presented in their complete form, herewith:

Summary of Report and Conclusions

"Because the ready availability of synthetic rubber is vital to our national security, disposal of the facilities must necessarily be contingent upon the assurance that, in private hands, they will be maintained as a going, progressive and readily expandible industry. Such assurance depends upon the ability of synthetic rubber to survive in competition with the natural product. In light of present conditions and those likely to prevail in the future, privately produced synthetic rubber would be fully competitive with natural, both technologically and in terms of price. Moreover, it is expected that the future world requirements for new rubber will so greatly exceed the available supply of both natural and synthetic as to necessitate the construction of new synthetic rubber facilities to satisfy the demand. This fact not only permits disposal but compels it, unless the government is prepared to become further committed to the manufacture and sale of rubber.

"In the transfer of these facilities to private ownership the disposal agency must create an industry pattern that, by avoiding situations of dominance and by assuring a supply of rubber to those users who do not purchase facilities, will permit the free operation of competitive forces. Because the number of possible situations is infinite, the Plan does not impose rigid standards to which the industry structure must be made to conform. Rather, within the limits of stated policy guides, it affords the disposal agency the flexibility of action necessary to adapt the industry pattern to the specific fact situations that may arise.

"Given this need for flexibility, sale of the facilities to the highest bidder in every instance under competitive bidding would be inappropriate. Accordingly, the Plan provides for the initial submission of indication of interest on the basis of which the disposal agency shall, in consultation with the Attorney General and the Federal Trade Commission, enter into contracts for such sales for the facilities as will provide, on an overall basis, a satisfactory competitive pattern for the industry and recovery by the government of the fair value of the facilities.

"A program affording such wide latitude to the disposal agency and relating to government facilities of such importance to the security interests of the nation should be reviewed by Congress before becoming effective. The Plan, therefore, provides that no sales become final until the Congress shall have had an opportunity to examine the program as a whole. If the Congress does not disapprove the sales, they shall be concluded and the unsold plants placed in standby, not to be offered for sale for one year.

"Because national security considerations permit the complete severance of the government's ties with synthetic rubber production the facilities should be sold outright. While the disposal agency should of course realize the maximum return for facilities consonant with the attainment of a competitive industry, the specific price that can be received for them will depend upon a canvas of the market; therefore, no hard and fast rules for price determination are proposed. So that the market for the facilities will not be unduly restricted, it is proposed that 80% of the sales price may be secured by a ten-year purchase money mortgage.

"The government, prior to the time of transfer, should schedule production so as to make available, when the plants are transferred, a maximum supply of rubber and its components compatible with foreseeable requirements. To ease the market stringency that may accompany transfer, this stock should be made available, to plant purchasers on a prorated basis, priced in conformity with government pricing policy immediately prior to disposal.

"Research in rubber should not be interrupted as a consequence of disposal. That research which is of direct interest to plant operations and commercial products clearly should be taken over by plant purchasers. It is recommended that the portion of the present government research program which will not be taken over by purchasers should be continued for one year after disposal. The question of future research is to be reexamined by the Congress at the end of that time, after the submission of a report and recommendations by the disposal agency."

[1] India Rubber World, Nov. 1952, p. 240.

Program for Plant Disposal

"Since the disposal must proceed contemporaneously with the operation of the rubber program, it is assumed that the responsibility for effecting disposal will rest with the agency charged with operating the program. The Plan, for which legislative authorization would be required, is as follows:

"1. The agency shall invite, upon adequate notice and advertisement, assumed to be not less than 90 days, indications of interest (bids) for the purchase of the facilities. Data concerning the plants which may reasonably be required for the submission of a bid will be furnished by the agency upon inquiry, if it is satisfied that the inquiry evidences a bona fide interest.

"(a) Bids shall be in writing, and shall contain among other things the following information:

"(1) Identification of the party in whose behalf the bid is submitted, including the business affiliations of such party.

"(2) The facility or facilities which are proposed to be acquired, and the order of preference if more than one facility is proposed to be acquired.

"(3) The arrangements, if any, which have been entered into formally or informally, for the supply of feedstock to the respective facilities proposed to be acquired, or the disposition of the end products thereof.

"(4) The price proposed to be paid for each of the facilities, and, if such price is not proposed to be paid in cash, then the major terms and provisions of the financing arrangement proposed.

"(b) Should it become necessary to the effective prosecution of the program for sale, the agency may disclose the contents of the indications of interest at such time, in such manner, and to such extent as it deems appropriate.

"(c) Bids shall be accompanied by a cash deposit, equal to 1% of the gross bid but not exceeding $100,000.

"2. Promptly after the termination of the period for the receipt of bids, and for a period not to exceed six months thereafter as may be determined and publicly announced by the agency, it shall negotiate with bidders, for the purpose of entering into definitive contracts of sale, which shall be binding and effective as to the agency and the bidder, subject only to the further procedures specified in paragraph 6 below.

"(a) In conducting these negotiations the agency shall be guided by the following criteria:

"(1) The government should realize the full fair value of each facility.

"(2) The facilities should be disposed of in such manner as best to provide for fair and effective competition in the production and marketing of synthetic rubber and its components.

"(b) The agency shall, after consultation with the Federal Trade Commission and the Attorney General, determine, as a matter of overall judgment, the sales which will achieve maximum conformance to these criteria, taken together and not severally.

"(c) All contracts of sale shall provide, among other things, that the contracts shall become fully effective upon the completion of the procedures provided in paragraph 6 below, and that the transfer of possession of the facilities shall be effected as promptly as practicable in accordance with the agreement of the purchaser and the agency, but in any event within a uniform, reasonable period after the effective date, say 60 days (transfer period).

"3. Upon termination of the transfer period, the agency shall discontinue the sale of rubber and rubber components except as provided in paragraph 4.

"4. Prior to the termination of the transfer period, production of synthetic rubber and its components for the government's account shall continue upon the direction of the agency, which shall schedule the operation of the facilities so as in its judgment to provide a maximum supply of synthetic rubber and its components as of the close of the transfer period. During the period of one year after the termination of the transfer period, the agency shall offer for sale to the purchasers of facilities the rubber or its components held by the agency, at a price determined in accordance with the pricing policy of the agency prevailing at the time of sale of the facilities, in amounts prorated in accordance with the ratio of the capacity of each facility purchased to the total capacity of all such facilities sold. Any rubber or rubber components not thus sold shall thereafter be disposed of by the agency in such manner as it deems advisable.

"5. Upon the termination of the transfer period, the properties which shall not have been sold shall be placed in standby as promptly as possible consistent with sound operating procedures. These properties shall not thereafter be operated for the account of the government except pursuant to further Act of Congress. After one year after the termination of the transfer period, these facilities may be offered for sale by the agency at competitive bidding or in such other manner as in its judgment will realize the maximum return upon the government's investment, consistently with maintenance of fair and effective competition in the industry.

"6. (a) As promptly as practicable after the termination of the negotiating period provided in paragraph 2, the Corporation shall prepare and submit to the Congress a report setting forth:

"(1) The steps taken to elicit bids;

"(2) The bids received and the sales proposed to be made;

"(3) In the event that there may have been a financially more advantageous offer for a particular facility than the offer accepted, a statement of the reasons why such sale is proposed;

"(4) The steps proposed to be taken to place the unsold facilities in standby;

"(5) an inventory of the government's then current stocks of rubber and rubber components;

"(6) A program and budget for the conduct of government research in rubber for the year following the transfer period.

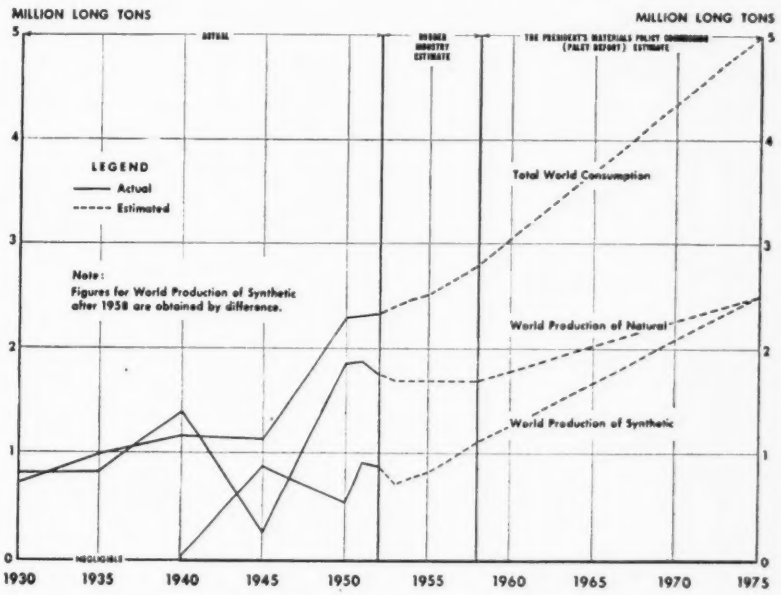
"(b) The report shall be submitted to both Houses of Congress on the same day and while each is in session. Upon expiration of 30 days of continuous session of the Congress following the date upon which the report is submitted to it, the agency may proceed to carry out the proposals, as outlined in the report, for the sale of facilities and for the placing of facilities in standby to the extent that these proposals are not disapproved by either House of Congress within the 30-day period.[2]"

Further Excerpts from the Report

In the discussion the competitive position of synthetic rubber it was assumed that its position in a free market is reasonably assured; therefore considerations of national security need no longer bar the transfer of the synthetic plants to private ownership as they did in 1950, but rather indeed should require such action as noted in the above "Summary of Report and Conclusions." Both butyl and GR-S have established their definite superiority to natural rubber for a great many bulk uses, and butyl rubber's superiority is decisive. It was still considered debatable if GR-S would be used in preference to natural rubber at a lower price, but the answer was said to be dependent on the amount of the price differential and the duration of such differential.

The cost of production and the pricing of synthetic rubber under government ownership afforded only limited guidance for an estimate of costs and price under private operation, it was said. For some period of time subsequent to disposal, therefore, the price of privately produced synthetic rubber will exceed the government selling price, if the government's

[2] "The period of time suggested for Congressional review has been borrowed from the somewhat comparable provision of Sec. 19 of the Surplus Property Act of 1944 (58 Stat. 765)."



World Consumption and Production of Rubber, 1930-1975

present pricing policy continues to prevail, according to the RFC report.

The supply-demand relation for new rubber on a world basis is shown in the accompanying chart from the report, which gives actual supply and demand for 1930 through 1952 and shows projections, first through 1598, and then to 1975. The significant thing to note is that the indicated deficiency of natural rubber in 1954 is 765,000 long tons and increases to 1,100,000 tons in 1958, a deficiency which must be satisfied by United States synthetic capacity.

For the long term, the chart indicates a deficiency of 2,500,000 long tons of new rubber in 1975, which suggests a need of greatly expanded capacity for the production of synthetic rubber since there appears to be no possibility that natural rubber will come into the market in the required additional volume. It also follows that natural rubber will not present any genuine threat to the market for synthetic rubber either by volume or price.

Therefore the RFC report concludes not only will synthetic rubber survive in competition with a natural rubber; there is an imminent need of additional synthetic capacity. National security considerations also not only permit disposal, but also compel it unless the government is prepared to broaden its commitments in the synthetic rubber field and expand the capacity of the government owned facilities.

In connection with the development of a disposal plan, it was pointed out that the economic and technological characteristics of the synthetic rubber facilities themselves, and the rubber, petroleum, and chemical industries as well, do not provide the most malleable material to bring into conformance with the aim of casting the industry into a proper competitive situation as between companies in accordance with the standards of our anti-trust laws. Because of the capital commitments and operating costs in both money and men required, the RFC report takes the position that entry of small business into the synthetic rubber industry is almost impossible.

Butadiene plants will almost certainly be sold to petroleum refiners, and rubber industry operators of copolymer plants will probably be the most interested in them. In addition, the mutual interdependence of the plants in the system create an occasion for intergration not consistent with desirable organization of an industry.

Two basic problems present themselves for solution if a climate for effective competition in the new industry is to be assured, it was said. The first is to assure such diffusion of capacity (butadiene, styrene, butyl, or copolymer) among a number of purchasers so that all may function efficiently; yet so that none of them stands in so strong a position as to dominate the field.

A second basic problem is to develop, for rubber fabricators generally, a truly competitive source of synthetic rubber supply, which would not be provided if the output of the plants were wholly captive to the demands of their owners, as fabricators, for synthetic rubber.

In 1952, RFC had about 700 synthetic rubber customers. Of these, the 20 largest tire companies accounted for more than 77% of the sales. The remaining 680 companies purchased only 23%, and of these, 20 absorbed more than 5%. Thus out of a total of about 700 customers, 40 accounted for 82%, and 660 accounted for only 18% of the RFC sales. Also, four of the majors alone accounted for more than 63% of total sales.

Transfer of some of the synthetic rubber capacity to enterprises not themselves large consumers of new rubber was suggested, since such an arrangement might also contribute to more rigorous competition in synthetic rubber technology.

Under the subject of price and terms of sale, the report takes the position that fundamental to any disposal program is the concept that the government must realize a price for the plants which fairly reflects their economic value as functioning units of a going industry. Realization of a maximum price cannot be the sole determinant, however, and what seems to be required is an accommodation among the conflicting requirements of technology, competition, and maximum financial return, it was added.

The RFC attitude on the present day "unrecovered cost to the American people" of the synthetic plants is open to question. The present-day book value of the plants of $172.6 million, plus the net operating deficit through December 31, 1952, of $199.7, plus loss on disposal in early postwar years of some of the plants of $74.1 million, resulting in a figure of $446.4, is likely to be criticized both as to amount and method of calculation, by prospective plant buyers.

Terms of sale suggested were 20% down and 80% in the form of a 10-year mortgage, although smaller amortizations may be arranged during the three years immediately following sale.

The possible contingency that after canvassing the market only a small portion of the total capacity is salable on reasonable terms was considered. In this eventuality Congressional review of the entire rubber program is called for.

In connection with future research on synthetic rubber, it is assumed that adequate development and applied research will be conducted by the private companies who may purchase the plants, but that fundamental research in areas where problems of major strategic importance remain to be solved, may have to continue as a government responsibility. The retention of the Government Laboratories at Akron and of some of the functions of the Tire Test Fleet were also suggested.

The RFC Disposal Plan provides that, at the time the disposal agency submits to Congress its report on proposed sales, it shall also submit a program and a budget for the continuance of government research for one year. When the effects of plant disposal can be perceived, the long-term research program should be reevaluated. Therefore the disposal agency should be required to make another report to Congress one year after disposal, containing specific recommendations concerning the conduct of synthetic rubber research by the government.

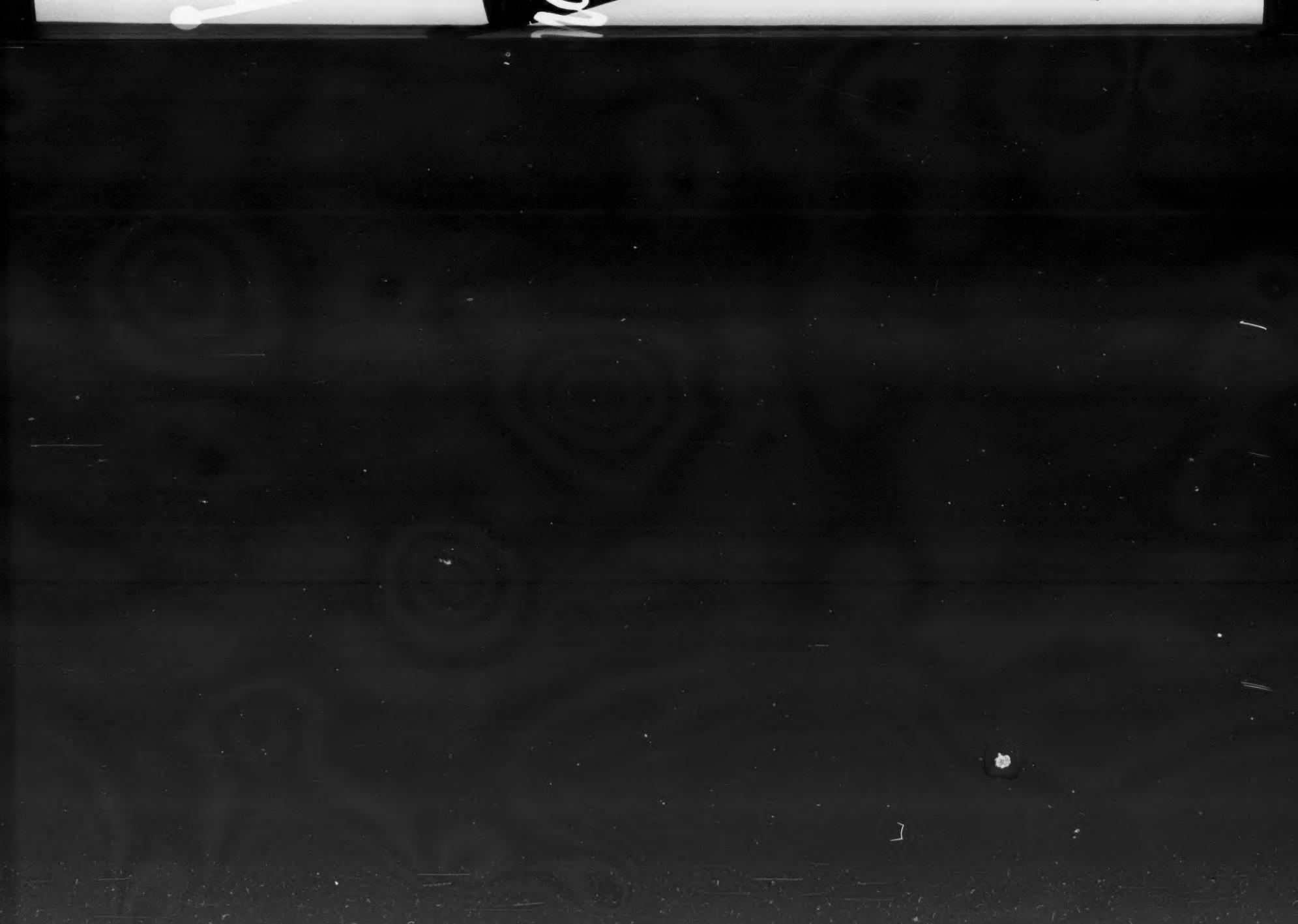
RFC Report Seems Generally Acceptable to Congress and Industry Leaders

Suggestions for the disposal of the government's synthetic rubber facilities to private industry began to take solid form last month following the RFC report, and, at the moment, the chance of seeing through a program for disposal could not be brighter. The long initial study period ended at that time with the presentation to Congress and the President of the 61-page report by the RFC recommending that Congress authorize negotiations looking toward the early sale of the government's 13 copolymer plants, its eight butadiene plants, the styrene plant, and the two butyl plants.

The RFC report was received favorably by influential members of Congress and is expected to have substantial endorsement from leaders of the rubber industry. President Eisenhower is expected to go along with the basic philosophy and suggestions of the RFC in his recommendations, due, under law, to be submitted to Congress by April 15. Already Representative Paul W. Shafer (Rep., Mich.), has announced that he intends to seek a conference with Mr. Eisenhower and White House aides, to communicate the views of the interested Congressional committees prior to April 15. Shafer heads the House Armed Services subcommittee to which the RFC report was referred. In the Senate the report initially was referred to the Senate Armed Services Committee, but jurisdiction was transferred the following week to the Senate Banking & Currency Committee, where it was referred to an RFC subcommittee, headed by Senator F. P. Payne (Rep., Maine). Sen. John W. Bricker (Rep., Ohio), who headed the Banking subcommittee on rubber legislation in the 80th Congress, is a member of the Payne subcommittee.

From all indications the President will go along with any reasonable disposal program. He told a news conference shortly after the RFC report was submitted that he does not favor having the government managing businesses that private industry can manage. More specific statements have come from Shafer and Bricker, both of whom are virtually certain to assume a major role in shaping the government's policy and program for disposal. Sen Lyndon B. Johnson (Dem., Tex.), who has taken such an important part in influencing government rubber policy since 1947, has not yet spoken, although pressed for his views by newsmen. A member of the Armed Services Committee, and former head of both its rubber and its preparedness subcommittees, Johnson is said to be still much interested in the rubber disposal question and will probably take some part in framing policy at a later date. Many of the rubber plants are in Texas, where the Senator, now minority leader of the U. S. Senate, stands for reelection in 1954. Johnson has been represented as believing that national security considerations are still involved in the disposal issue, and he probably can be counted upon to insist that the final disposal program adopted provide adequately to protect the national security interest in rubber.

Shafer so far has provided the most detailed comment on the RFC report in a statement he inserted in the "Congressional Record" on March 5. This statement amounted to an enthusiastic endorsement of the major proposals of the RFC report, but also took exception to several others. Sen. Bricker said he thought "On the whole, the plan is sound"—noting as "strong points" RFC's suggestion for negotiated sale, for outright disposition of the plants, and for a review of the entire disposal program by Congress once contracts are negotiated.



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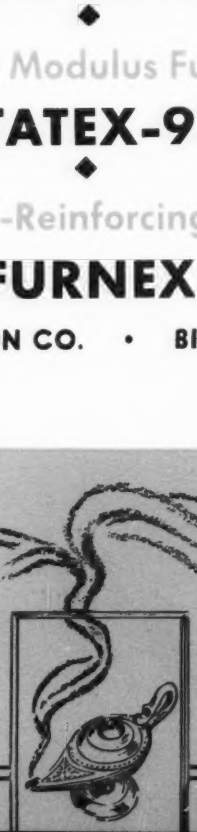


He had one "reservation" about the RFC report. He was not happy about the emphasis placed by RFC on its suggestion that the basic aim guiding disposal should be the creation of what the Senator called "a so-called competitive pattern for the industry."

Bricker said this might give "economic planners" a hand in deciding to whom the plants are sold. He added, however, that this point is a "weakness of the report that can be overcome by sound administration of the program." He was not specific on what dangers he saw in "economic planners" taking a hand in the program, but his concern is believed to stem from suggestions in the report that petroleum and chemical firms might try to purchase some plants, as they would be free to do under the RFC plan.

Both Shafer and Bricker have indicated they will be ready to introduce disposal legislation once the President's recommendations are in the hands of Congress. Shafer has pretty clearly indicated that the outlines of his bill will follow the RFC recommended program, except possibly on the question of conducting sales by negotiation. He prefers that the government call for firm competitive bids and sell to the highest bidder, except where public policy dictates bypassing the highest bidder. In such cases, he still wants the figure named in the high bid to serve as the basis for any negotiations with other prospective buyers. Bricker has indicated that he is prepared to introduce any bill which the rubber companies can agree upon. It is not yet known whether the industry is drafting legislation for introduction in the Congress. Shafer claims enthusiastic industry support for the disposal suggestions he advanced in a House speech[3] February 18; so it seems unlikely that if industry initiates any disposal program on its own, it would differ very much from the generally identical RFC and Shafer proposals. It seems doubtful that the White House will come up with any new proposals. The President is expected to go along with the RFC recommendations, most probably with a general endorsement of them, leaving any disputes over detail to be reconciled by Congress, the RFC and private industry.

The Building vs. Negotiating Controversy

The major trouble spot would appear to be the question of whether negotiation or competitive bidding should guide disposal, particularly as it impinges on the prices at which the plants are sold. Shafer is concerned lest more-or-less pure negotiation result in the government receiving lower prices for its facilities than their present value. Where he criticized the RFC proposal in his March 5 statement, he suggested alternatives imposing stiffer requirements to assure a high return to the government. Both RFC and Shafer agree on disposal at the maximum financial return to the government consistent with the creation of a competitive, privately owned, privately operated, and privately motivated synthetic rubber industry. Both seem agreed that existing rubber companies are ready and eager to help bring this about. They are also aware, however, of the recorded views of the rubber industry, presented in a "unanimous" report to RFC last August, calling for pure negotiation, tilted toward favoring sale to rubber firms, and playing down the importance of price as a condition for disposal.

[3] India Rubber World, Mar., 1953, p. 813.

No one is so optimistic to expect the high degree of harmony which seems apparent today to continue throughout the selling period.

RFC's deputy administrator for disposal, Morton E. Yohalem, quite frankly has stated he expects "quite a hassle" over selling prices. Shafer, on the other hand, feels that the entire disposal situation can be settled far more quickly than the 15 months Yohalem figures on in his report. The Michigan Congressman statements indicate he intends to take a personal role in seeing disposal achieved as expeditiously and with as few attendant complications as possible. The two statements by Shafer, one anticipating the RFC report by two weeks and the other strongly endorsing it as "a reasonable framework for legislation for the disposal of our synthetic rubber facilities," were clearly calculated to nip in the bud the chance of discord developing over the major conditions of a disposal program.

Also, Shafer served notice that he hopes to retain in the dominion of the House Armed Services Committee the exclusive right to grant final approval to sale contracts. He took strong exception to RFC's suggestion that once negotiations are completed, final approval of the contracts be put up to the full Congress. He warned that this arrangement could "turn the Congress into an open forum for rejected bidders" and in effect is telling RFC to go ahead and bargain on its own terms without deferring to any legislators who might bend a ready ear to the injured feelings of their corporate constituents.

The present differences between Shafer and RFC on the question of competitive bids based on firm bids as against the suggestion of "indications of interest" serving as the basis for subsequent negotiations is one of degree, more than substance, at least in the view of RFC. In any event Shafer recognizes the merit of RFC's reasoning that a pure competitive bidding procedure would leave the government with no control over who buys plants, thus endangering the aim of creating a competitive synthetic rubber industry. The Michigan Congressman said he was quite impressed with what the rubber companies showed his subcommittee on a visit to Akron in late February, particularly the new developments being turned out in company laboratories. He also feels, however, that the companies, eager as they are to get the government out of the rubber business, are no more prepared than the government to do this at any price. For instance, he took exception to RFC's suggestion that any plants unsold in the first disposal go-around be offered for sale a year later. He wants a two- or three-year waiting period. One year is "too short a period," he said, because it "might possibly tend to lower the price the government might receive for all these facilities. It is just possible," Shafer reasoned, "that some people might be willing to wait a year before attempting to enter the synthetic rubber market."

Other Comments by Shafer

Here are some other things Shafer said about the RFC report:

"The report is exceptionally well done. It is not too much at variance with what I told the House (February 18) with respect to the disposal of this tremendous government-owned industry to private enterprise. And I congratulate the RFC for recommending disposal, and for submitting not only a complete justification for disposal but also what appears to be a plausible and workable disposal plan.

"I think one of the most telling statements in the report is that dealing with the necessity for disposing of these plants to private enterprise. It is obvious, as indicated in the report, that the demand for synthetic rubber, in fact the demand for all types of rubber, will increase tremendously in the future. As the report indicates, the demand for synthetic rubber has already increased and will continue to increase to such an extent that new synthetic facilities will be required. Therefore, either the government, if it is to retain this industry, must expend large sums of money and expand its own monopoly or we must turn these plants over to private industry and permit them to build the new facilities that are inevitable. Private industry obviously won't invest its own money in competition with the government, or build plants when the threat of sale of the existing facilities hangs over their heads."

Shafer said he regards as "sound" the suggestion of RFC that purchasers be permitted to make a down payment with the government taking back a purchase money mortgage for up to 80% of the agreed price. He said he was "particularly pleased" that RFC rejected the "functional payment plan" suggested by industry in the past whereby purchasers would pay for the plants out of the proceeds from the rubber produced by those plants. The RFC suggestion was prompted, although RFC does not say so in its report, by a regard for smaller companies which might want to buy plants. By allowing different rates, smaller firms would be in a position to take advantage of government credit facilities should they have trouble getting financial backing from commercial lending institutions. Government loans carry higher interest rates than those available privately to large, well-established private firms, such as big rubber firms.

Shafer was pleased that RFC suggests a "complete cleavage of the government from the synthetic rubber business when the facilities are sold. The only exception," he noted, "would appear to be continuing research and the operation of the government laboratory in Akron." He thinks the laboratory should be kept in business under government management, as at present. He said it does not cost very much to run.

As for building up an inventory before disposal, he had the following to say: "I think the idea of establishing a rather substantial inventory of rubber, butadiene, and styrene prior to the transfer of the plants to private industry is sound. But if the purpose of the large inventory is to take care of a transition period between government ownership and private ownership, then to me it would seem more plausible for the government to sell the inventory to consumers rather than to prorate it among the purchasers of the facilities. Perhaps it would be advisable to prorate the butadiene and styrene among the purchasers of copolymer plants, but I can see little justification for prorating the rubber in the inventory at the then existing price, among purchasers of the facilities. As the report indicates, the inventory to be established will prevent a temporary price increase in synthetic rubber that might otherwise take place. It may also solve the problem of the present butadiene shortage which requires us to operate two alcohol butadiene plants, to produce butadiene that is

approximately twice as expensive as petroleum butadiene. I seriously doubt whether anyone will ever buy an alcohol butadiene plant, but perhaps as the report suggests, we can obtain some return from these plants which would pay for their standby costs by permitting their leasing during periods of shortage of butadiene. I want to make it clear, however, that these two facilities are the only ones I personally would ever consider leasing."

The Michigan Congressman also said that he is "happy to see that the report contemplates a variety of integrated sales. I am convinced in my own mind that purchasers of copolymer plants must be sure of their supply sources before they will enter into a firm bid for a copolymer plant; and likewise, a butadiene producer would want to be sure of a market for his products in a copolymer plant or plants. Unfortunately, a copolymer plant has only one use, and that is to copolymerize butadiene and styrene. This is also true to a lesser extent of a butadiene plant, in that the function of that type of facility is to manufacture butadiene which can only be used as a component for GR-S. However, I am also convinced that the potential use of butadiene for purposes other than as a component of synthetic rubber is very real."

In sum, Shafer had this to say of the RFC report: "All told, I think the RFC report can, without question, be used as a reasonable framework for legislation for the disposal of our synthetic rubber facilities. There may be some disagreement with regard to details, but the overall principles regarding the disposal of these facilities are sound. While I have not been able to give this report thorough study, my first reaction is that it makes good sense; presents a clear picture of all the problems; and proposes a reasonable solution."

While in this March 5 statement Shafer repeated his earlier statement that the facilities are good facilities and should be sold for full value, he did not repeat a specific price figure or his earlier threat that if disposal fails to go through, then the government should boost its selling price for GR-S. In his February 18 statement he made disposal a now-or-never proposition. If industry will not buy the plants at their current value—"at least $350 million" in his view—then Congress, he said, should authorize the government to continue as monopoly operator until the plants fall apart from decrepitude. Coupling this action with a higher price for GR-S would add millions of dollars a year to industry's raw material costs.

Capehart-Bush Bill Could Delay Disposal

Senators H. Capehart and P. Bush, in a bill introduced March 20 (Sen. 1410), would grant President Eisenhower an additional 90 days from April 15, 1953, to submit his recommendations for the disposal of the government-owned synthetic rubber plants. The purpose of this bill, which would make the President's recommendations due on July 15, after Congress had adjourned and probably delay disposal for about a year, is to allow sufficient time for the Treasury Department to make a broad financial study of the operations of RFC with the aim of dissolving the Corporation in April, 1954.

The Capehart-Bush bill, if passed, would be a very great blow to the hopes of RFC, those members of Congress interested in reasonably prompt disposal of the synthetic rubber plants, and the rubber industry.

Shafer indicated immediately that he did not plan to let the Capehart-Bush bill interfere with his plans for disposing of the synthetic rubber plants as soon as possible. He still feels that now is the time to settle the synthetic plant disposal issue, irrespective of other considerations and even indicated that the House would fight the Capehart-Bush bill if it passed the Senate and was sent to the House.

The House Armed Services rubber subcommittee plans to vist the Copolymer Corp. operated government plant in Baton Rouge, La., during the Easter recess. Hearings on a disposal bill were scheduled to begin shortly thereafter. Shafer was not sure whether he will introduce his bill for disposal before or after the hearings take place.

On March 24 the results of a discussion between Capehart and Bricker brought forth a revision whereby the Capehart-Bush bill extension of time for the President's report was reduced from 90 to 30 days. This means that the Eisenhower report will be due on May 15 instead of April 15 and that disposal legislation may still be introduced during the present session of Congress.

Shafer indicated he would not oppose the Capehart-Bush bill with this new 30-day extension. He now plans to start hearings, therefore, on or about May 20.

State Department Group Reviews "Buffer Stock" Plan

United States State Department experts on rubber met with the Department's Rubber Industry Advisory Committee in Washington on March 5 to report to the industry group on what took place at the January session of the Working Party of the International Rubber Study Group in London, where the Working Party discussed a tentative "buffer stock" scheme, the purpose of which is to prevent either burdensome surpluses or shortages of natural rubber in the world market and thus help attain a stable price for that commodity.

The Working Party went no further than to state that it had agreed that the development of a "buffer stock" scheme is feasible, noting that even for the particular scheme it had talked about in London many details remain to be worked out. These are believed to concern prices as well as the period of time the plan would be operative.

Neither State Department officials nor the industry members in attendance would comment on the discussion at their March 5 meeting. A similar meeting, scheduled for April 1, will probably be the last such formal exchange of views before the U. S. delegates (State Department representatives) leave for the full-dress annual meeting of the Rubber Study Group in Copenhagen this May.

Lacking any other indications, it seems apparent that there have been no substantial changes in the American position and no commitments to favor a buffer stock or any other rubber stabilization program. American industry, as the largest consumer of natural rubber, retains bitter memories of previous stabilization schemes managed by the producing industry. At the London meeting the United States was reportedly assured of a virtual veto power in any future buffer stock agreement to which it becomes a party, but this is not expected to sway opinion to endorsing such a scheme.

There seems to be agreement—here and among producing countries—that creation of a stabilization scheme is impossible without full American support. The natural rubber producing countries, even with the cooperation of other consuming countries, could not go it alone. Not only is the U. S. the largest consumer of natural rubber at present, but it has an enormous real and potential power over the market through its synthetic rubber industry and its vast government-owned stockpile of natural rubber, a quantity fully able to carry America through seven years of war.

Nevertheless the problems of the natural rubber producing areas are real and unquestionably have been aggravated by American and British political moves to deny natural rubber to the Communist dominated areas of the world. Since the outbreak of the Korean war, all members of the United Nations have agreed to bar shipments of war material to Red China. Also, since then, no rubber has been shipped from Malaya or Britain to Red China (although normal volume has moved to the British colony of Hong Kong). Malaya and Britain have cooperated to confine shipments to the Soviet Union to a volume deemed normal for civilian needs in that country, something on the order of 100,000 tons annually.

Red China, particularly, has sought additional supplies and has recently concluded a rice-for-rubber deal with Ceylon.[4]

The Ceylon deal with Red China is not regarded favorably or in any sense as a model by other Asian natural rubber producers, even though these other producing countries likewise need to import rice and today find their market for rubber diminished by a combination of a reduction in American purchases of natural rubber and their adherence to the American policy of depriving the Communist bloc of rubber. These other producing countries feel that their support for this American policy—when translated into plain terms means a loss of the potential Communist market to them—should find America willing to help support the rubber economy of Asia.

A few weeks ago, Sen. Paul Douglas, Illinois Democrat, suggested in a radio interview that we should buy the 50,000 tons of rubber a year from Ceylon to keep it out of Red China's hands and also provide the quantity of rice which Ceylon is to get from Red China. Aside from the fact that our stockpile purchases from other Asian producers who are depriving themselves of the Red market would have to be reduced, these other producers might infer that they too would get a better deal from America by threatening to ship their rubber to Red China than by denying themselves that market. Such an inference is not imaginary, particularly in view of the present dissatisfaction among these producers with American rubber policy. At the moment this dissatisfaction is somewhat more muted than a year ago, largely because of our willingness to listen to their buffer stock proposals, the present generally satisfactory market price of natural rubber, and the belief of rubber producers

[4] Details of this deal have been and are reported in the Foreign News section of India Rubber World. Editor.

that disposal of the government's synthetic rubber facilities will result in removing the threat of price competition to natural rubber.

This last hope, however, probably is born of wishful thinking. Some day in the not too distant future the natural rubber producers will realize that low priced synthetic rubber in tremendous volume will dominate the scene as a permanent fixture. Coupled with the rising costs (chiefly labor) of producing natural rubber, this is almost bound to result in a quickening of the pressure either to open up the Communist market to more natural rubber or for American agreement to market stabilization schemes for natural rubber. The entire question begs for harder thought than it has been getting both here and abroad and more than "quickie" expedients masking as solutions.

Government Rubber Output and Sales

RFC, meeting with its rubber industry advisory committee early in March, came up with some new figures on its expected production and sales of synthetic rubber this year. RFC informed the committee that it expects to produce 774,161 long tons of GR-S in 1953, about 25,000 tons more than it had estimated several months earlier. The figures, which cover net weight of rubber plus oil (added to oil masterbatch types) and the dry content of GR-S latex, break down as follows on a quarterly basis: First quarter, 172,961 tons; second quarter, 200,200 tons; third quarter, 200,500 tons; and fourth quarter, 200,500 tons.

The consuming industry has forwarded to RFC estimates of its purchase requirements for the first six months of 1953. These total 369,843 tons of GR-S, which break down as follows on an average monthly basis: January, 57,700 tons; February, 64,700; March, 62,100; April, 61,700; May, 61,700; and June, 61,600. Taking the projected output as against industry consumption requirements, RFC expects to end the year with a government-held inventory of GR-S of between 75,000 and 100,000 tons, or some 50,000 to 75,000 tons greater than the inventory held by RFC at the end of 1952. This will still fall short of what RFC and the industry would deem desirable to tide over consumers during a transition of the synthetic rubber facilities from government to private ownership.

RFC also plans to produce during 1953 a total of 81,120 long tons of butyl rubber, broken down as follows on a quarterly basis: First quarter, 17,920 tons; second quarter, 16,900; third, 22,400; and fourth, 23,900. Industry's consumption requirements total 41,547 tons for the first half of the year. At present, and through the first half year, consumption runs slightly above production. The inventory situation for butyl is satisfactory, however, and production, as can be seen from the above quarterly figures, will be increased in the latter half of the year. The relatively low second-quarter figure is explained by the turn-around of one butyl plant in June.

February sales of GR-S actually amounted to 55,561.1 long tons broken down as follows: LTP GR-S, 32,647 tons; black masterbatch, 8,487.3 tons; oil masterbatch, 8,641.1 tons; oil-black masterbatch, 1,969 tons, and latex (dry weight), 3,774.2 tons. Masterbatch figures are gross weight including oil and/or black. Sales of butyl rubber amounted to 7,617.1 tons.

Production of GR-S for March, amounting to 64,068 long tons, was detailed as follows: LTP GR-S, 42,068 tons black masterbatch, 8,802 tons; oil masterbatch, 12,745 tons; oil-black masterbatch, 2,232 tons, and latex (dry weight), 3,825 tons. All masterbatch figures are gross weight as before. Butyl rubber production was scheduled to the amount of 7,100 tons.

RFC Buying Alcohol

RFC, on March 16, asked for offers of 20 million gallons of alcohol for delivery in April, May, and June, for operation of the government alcohol butadiene plants at Louisville, Ky., and Kobuta, Pa. The agency set a March 26 deadline for receiving quotations, specifying minimum offers of 100,000-gallon lots. The rate of delivery is to be five million gallons in April, 7.5 million in May, and 7.5 million in June. Following the same procedure of its earlier purchases made in January, RFC will negotiate privately on the basis of quotations received.

In January, RFC bought 15 million gallons for delivery in equal amounts over February, March, and April to feed the four lines reopened at the butadiene plants. It bought the alcohol from Eastman Chemical Products, Inc., Enjay Co., and Publicker Industries, Inc., but did not disclose the purchase prices.

Some of this alcohol, a small quantity, went into butadiene in February, which was then sold to private industry at 32¢ a gallon. RFC officials explained that this action was due solely to the fact that some of the reactivated butadiene units went on stream a bit earlier than expected and ahead of the time when the consuming copolymer plant at Institute, W. Va., was ready to use it. This plant, reactivated by RFC, is now on stream and using all the butadiene RFC plans to produce from alcohol. The private sales of alcohol butadiene were made to the former customers of RFC who had bought alcohol butadiene last summer and fall. These customers lost this source of supply when the butadiene units were ordered into standby, and lost it again when the Institute plant went on stream.

FTC Tire Quantity Discount Ruling Has New Angles

The future of the Federal Trade Commission's quantity discount limit rule on manufacturers' sales of replacement tires and tubes is a matter of fresh speculation as a result of the sharply changed character of the FTC which has taken place in the last several weeks.

The FTC, using for the first time a power it held for 16 years, issued in January 1952,[5] a rule limiting the top quantity discount for replacement tires and tubes to that granted on a 20,000-pound order at a single time for a single delivery. The ruling was set to take effect April 7, 1952, but the federal courts have put off the date indefinitely as a result of legal action taken by virtually all tire manufacturers and a few dealers to have the ruling permanently nullified. Motions of these plaintiffs to have the ruling temporarily and permanently enjoined before it could take effect were denied by the Federal District Court in Washington and are now on appeal to the Federal Court of Appeals. The District Court said the plaintiffs should avail themselves of FTC procedures for testing the fairness and legality of the ruling before taking it to court.

The ruling was approved by a 4-to-1 majority of the FTC, with Commissioner Lowell B. Mason, at the time the only Republican on the FTC, dissenting. Since then the make-up of the FTC majority has changed with Albert A. Carretta, a lawyer, named to the Commission, who has sided with Mason on a number of important issues. The term of office of the FTC's chief proponent of the tire limit ruling, John Carson, has expired, and President Eisenhower, on March 4, named Edward F. Howrey, a lawyer and conservative Republican, to succeed Carson. Of the original four-man group which voted for the tire limit rule, only James Mead and Stephen J. Spingarn, both Democrats, remain. Mead plans to stay on, although he won't remain as chairman, to finish his term, which expires in 1955. Spingarn's term expires this September, and he is bound to be replaced, although perhaps by another Democrat or independent.

In meetings of the Commissioners on questions of what position to take in response to tire company motions for postponement of the controversial ruling, Spingarn has carried the fight, with somewhat less zealous support from Carson, for immediate enforcement of the ruling. The majority of the FTC, lead by Carretta, prevailed, however, by authorizing government counsel to accede to a temporary postponement of the ruling pending the outcome of the companies' appeal to the Court of Appeals.

Howrey's nomination was opposed before the Senate Commerce Committee by the irrepressible George V. Burger, vice president and Washington representative of the National Federation of Independent Business. Burger, who claims to have originated, aroused, and sustained the FTC's interest in the idea of imposing a quantity limit on tire discounts, questioned Howrey's sympathy with the policies and purpose of the FTC to protect small business against unfair and monopolistic acts by larger competitors. Among other things, he noted that Howrey, since the tire limit case was instituted two years ago, has been the attorney of record in those proceedings for the Firestone Tire & Rubber Co. Burger also charged that Carretta was not in sympathy with the ruling and contended that the Howrey nomination, if confirmed, would result in a 3-to-2 FTC majority against efforts to use regulations for protecting independent tire dealers from being pulled under in their fight for economic survival. Despite his opposition, the Committee approved the nomination, and the full Senate is expected to confirm Howrey very soon.

Burger's description of the threat to ultimate enforcement of the tire limit ruling may be too pat. The government's case is being handled by the Justice Department, through its U. S. Attorney in the District of Columbia, not by FTC attorneys. Even if the new FTC majority should wish to quit the fight, the Justice Department could refuse to do so. In legal maneuvers of the past few months, however, the Justice Department has accepted informal guidance from the FTC on what course it should pursue in the courts, and there is no reason to expect Justice to put up a fight for an FTC ruling if the Commission wished to abandon that ruling.

[5] India RUBBER WORLD, Feb., 1952, p. 602.

Also, there is uncertainty as to the extent Howrey, in view of his prominent role as Firestone's attorney in fighting the ruling, would participate in FTC deliberations on the tire limit ruling. He may disqualify himself from any consideration of the FTC's position in the matter. In addition, while the general economic philosophies of the Mason-Howrey-Carretta majority may be assumed to favor a voluntary rather than a regulatory approach toward seeking compliance with the laws protecting small business from unfair competition, the three may not agree in all cases or to the same degree on how to go about it.

Mason has not only been a steady dissenter from most of the previous Commission's important decisions, but also has lambasted his colleagues with sarcasms. He even tried to have the federal court remove his name as a defendant in the tire ruling litigation, but was turned down by the judge. There is little doubt that Mason would welcome an opportunity to kill the tire ruling, if such an opportunity arose.

Carretta thus far has not expressed himself on the merits of the tire limit ruling —a ruling issued before he joined the FTC. It was his suggestion, however, that the FTC (with Carson and Spingarn dissenting) advise the Justice Department to agree to allow the tire companies and associated plaintiffs sufficient time to make an appeal of District Judge McGuire's decision denying the injunctions sought by those plaintiffs. On the other hand, Carretta also insisted that this further postponement of the ruling be limited strictly to the time necessary for such an appeal. Thus far Carretta has stood for defending FTC actions from challenge in the courts, while giving those challenging the action a reasonable opportunity to press their suit.

At the moment it is still unknown who will be the President's choice for chairman of the FTC; most observers, however, believe it will be Howrey.

It seems doubtful that the FTC, even assuming majority opposition to the tire limit ruling, would act hastily to wipe it off the books. The Eisenhower administration would be open to criticism by Democrats of any rash move to scuttle action taken by a Democrat regime to protect small business.

There remains the possibility of consigning the present tire limit ruling to a slow death, assuming a majority of the FTC wants to do so. There are strong arguments in favor of such a course in that the present ruling will probably be fought tooth and nail by tire manufacturers, through the Supreme Court, if necessary. The FTC could take the position that a long, drawn-out fight won't help the independent tire dealer, since he would have no tire discount limit ruling to protect him during the course of litigation. Even if the plaintiffs lose in the Supreme Court in their current effort to kill the ruling before it takes effect, they could be expected, once the ruling went into effect, to violate it forthwith in order to test the ruling's validity. Enforcement would be stymied until the courts completed their review.

If such a situation developed, the FTC might very well decide to drop its present ruling for a less drastic one, already suggested by the National Association of Independent Tire Dealers that discounts be limited on the basis of annual purchase volume. NAITD has stood steadily for a ruling limiting manufacturers' discounts to annual sales of $600,000. A purchaser whose annual purchases of tires and tubes amounted, say, to $1 million, would be able to get only the maximum discount available on the first $600,000, and on the remaining $400,000, could get only the discount customarily granted by the manufacturer to any dealer buying $400,000 worth of tires and tubes annually. Should the FTC elect to substitute this type of ruling (a $250,000 annual volume limit also has been suggested), it might pick up more support among independent tire dealers than it would lose. NAITD has adopted a neutral position on the present quantity limit ruling, pointing out that it thinks the annual purchase volume-type limit would be more to the interests of its members. Those 35 independent dealers presently allied with the manufacturers against the present ruling have declared in their briefs to the court that they favor the original $600,000 tire limit ruling suggested by NAITD. There are sound reasons for believing the tire manufacturers would accede to a $600,000 volume limit if the alternative was a long, costly, and lonely fight in the courts. One of the chief objections of the tire manufacturers to the quantity limit is that it would require them to make a complete change in their customary method of granting discounts, that is, the method of applying discounts on the basis of annual purchase volume.

Two more brief news items touching on this situation are:

(1) Burger filed two motions with the Court of Appeals: one asked that the stay orders issued by the District Court in December be nullified, and the other asked that Burger be permitted to file a brief and be heard in oral argument as a friend of the court (in support of the government). Both motions were promptly denied.

(2) Rep. Wright Patman, of Texas, ranking minority member of the House Small Business Committee, introduced H. R. 3378, which would write into law the FTC's policy on quantity discounts. The bill would make such sales unlawful unless the seller advised all his customers that the same price and/or discount is available to them under the same conditions. The bill was referred to the Judiciary Committee, where it is expected to find a ready pigeonhole.

Synthetic Rubber Labeling Bill Again Introduced

A bill to require the labeling of certain articles containing synthetic rubber (H. R. 3368) was introduced February 23 by Rep. Davis (Dem., Ga.) and was referred to the House Committee on Interstate and Foreign Commerce.

The measure is designed to inform the ultimate consumer whether wearing apparel contains synthetic rubber and would empower FTC to issue and administer such labeling regulations to carry out this purpose.

As such, the bill—on which no committee action is currently scheduled—is less drastic than the synthetic rubber labeling bill introduced by Davis in the last Congress. That measure, which failed to clear the Commerce Committee after a brief hearing, was broader in its application, covering a wide range of rubber products, outside of tires and other transportation items.

The present measure would require FTC to make regulations "designating all articles of wearing apparel and all articles intended for personal use in frequent or sustained contact with the skin of the user, which contain or are composed, in whole or in part, of synthetic rubber."

FTC would be required also to set standards for labeling such articles in a "manner adequate to inform the user" that they contain synthetic rubber and set requirements "that the name, or other identification issued and registered by the Commission, of one or more of the persons who introduce such articles in commerce, or sell, transport, or distribute such articles in commerce, shall appear on labels required" under terms of the bill.

The bill makes it unlawful to manufacture or distribute any such articles that do not meet the labeling and registration regulations of the FTC. It would also be unlawful intentionally to remove, mutilate, or obliterate the label before the article is sold to the consumer. The bill gives the FTC one year in which to put its regulations into effect.

Goodyear and General Sign New Contracts with URWA

After seven weeks of continuous negotiations a new contract on working conditions was signed on February 28, between the Goodyear Tire & Rubber Co. and the United Rubber, Cork, Linoleum & Plastics Workers of America, CIO.

"Although 25 basic improvements were made over the old contract," L. S. Buckmaster, URWA president, observed, "no wage demands were involved, since our union has not formulated an economic program for 1953. The International Union's Policy Committee meets on March 13-14, in Cleveland, to adopt appropriate goals," he added in a statement in the March issue of the "United Rubber Worker," union publication.

"Under the 30-day reopening clause," he said further, "either party has the right to cancel the entire agreement if a wage settlement is not reached."

Outstanding gains claimed by the union were: (1) renewal of the union shop; (2) intraplant and interplant pay scale adjustments; (3) liberalization of severance pay; (4) increased vacation and holiday benefits; (5) improved recall system; (6) liberalized safety and health provisions.

In the future, workers with three years of service will receive two-week vacations. Five years' service was required previously. One week after one year and three weeks after 15 years of service still prevail.

Triple time will be paid when any of the six holidays are worked. Protective clothing upon hazardous occupations will be provided by the company.

After ratification of the master contract, the local unions covered will begin negotiating upon their individual supplemental agreements, each to cover the working conditions peculiar to the respective plants. A total of 30,000 Goodyear employes is covered by the contract.

On March 13 a new two-year contract covering 3,300 employes of The General Tire & Rubber Co. and the URWA was signed. This contract also included triple time for holidays, two-week vacations after three years' service, and liberalized clauses governing seniority, holidays, and transfer provisions. Seven weeks of negotiations were required to reach agreement on this contract also.

Meanwhile, negotiations between U. S. Rubber and the URWA, which began in New York, N. Y., March 2, are continuing.

Arthur Nolan, 1075 Hull St., Baltimore 30, Md., has been appointed representative in the United States for Union des Planteurs de Caoutchouc, 3 Square Pétrarque, Paris-XVI, France, which represents all planting industry of Indo-China.

General Tire to Build Plant in Holland

Construction of the twelfth foreign plant of The General Tire & Rubber Co., Akron, O., will begin soon, according to J. A. Andreoli, executive vice president of The General Tire & Rubber Export Co. The plant will be located in Holland. Plans have been completed, and engineers are on the job at the plant site in the West Haven area of Amsterdam.

"This move is part of our foreign expansion program, which is geared to provide more accessible sources of supply for our customers in foreign countries," Andreoli said.

The plant is scheduled to be in operation before the end of the year, producing tires and tubes for automobiles, trucks, buses, airplanes, and farm equipment.

General's other foreign plants are in Chile, Mexico, Venezuela, Brazil, Israel, Spain, Union of South Africa, and two each in Canada and Portugal.

The company also maintains technical service affiliations with rubber manufacturing plants in Germany, Italy, and Switzerland.

Steam Jet Process for GR-S

A new contribution toward the production of GR-S, described as a "steam jet" process of mixing carbon black into latex, was announced by Copolymer Corp., Baton Rouge, La., March 16. According to Col. C. M. Hulings, operating vice president of the firm, the process results in a tougher rubber than any hitherto available at reductions in both initial and processing costs.

The process involves the use of a jet-like fitting in the flow lines of conventional GR-S operations. The fitting has three apertures: one for liquid latex, another for "black slurry" (a mixture of carbon black and water), and a third through which high-pressure steam is applied to disperse completely the slurry throughout the latex. The water is driven off later in conventional drying equipment.

Tires made of "steam jet" cold GR-S have been given road tests in Texas by the government fleet, and preliminary findings after 18,000 miles of driving are said to show a 20% improvement in tread over control tires made of the best cold rubber treads produced by other methods. In addition, rubber made by the new process eliminates the use of wetting agents needed for standard black masterbatch production. Under the RFC synthetic rubber program, the new process is now in pilot-plant production at Baton Rouge and will also be made available to the entire synthetic rubber industry.

First-Quarter Sales Up

Dewey & Almy Chemical Co., Cambridge, Mass., held its annual stockholders' meeting on March 26. The existing board of directors was reelected, as were also A. T. Daignault, treasurer, and W. T. Snow, clerk. Hugh S. Ferguson, president, said that sales for the first quarter are well above those for the corresponding period in 1952. New orders for Cry-O-Rap bags, in particular, have shown considerable improvement, and sales of machines for applying these bags have been continuing at a high level.

High-Altitude Pressure Suit

Goodrich Space Suit

The B. F. Goodrich Co., Akron, O., has developed a high-altitude pressure suit which permits aircraft pilots to remain alive in altitudes up to 100,000 feet in the event that his pressurized cockpit fails, or he must bail out. The suit carries its own supply of oxygen and air under pressure and is inflated automatically in the event of an emergency.

Wins Advertising Award

The industrial advertising campaign of the Goodrich company has been cited as "the best of 1952" by *Industrial Marketing*, a national monthly business magazine. H. E. Van Petten, advertising manager of the company's industrial and general products division, was named "adman of the year" and was presented with a framed citation signifying the award. Kenneth W. Akers, president of the Griswold-Eshleman Advertising Agency, was also honored by the magazine for his work in developing the campaign which began in 1934.

Koroseal Footwear

A new-quality Koroseal upper material for all types of shoes has been announced by Goodrich. Manufactured in a wide range of colors, the waterproof material is said to be resistant to scuffing, cracking, or peeling and can be cleaned with a damp cloth or with soap and water. Shoes made of this material were displayed at the Allied Shoe Products & Style Exhibit, March 1-4, at the Hotel Belmont Plaza, New York, N. Y.

New Raybestos Warehouse

Raybestos-Manhattan, Inc., Passaic, N. J., has moved from 445 Lake Shore Dr., into its newly constructed Chicago, Ill., office and warehouse building at 6010 Northwest Highway. This new building provides greatly expanded facilities for warehousing mechanical rubber, packings, and asbestos textiles and for Chicago sales offices of these products as well as national sales headquarters for the equipment sales division.

Goodyear Engineers at ASTE Meeting

The American Society of Tool Engineers heard addresses from two Goodyear developmental engineers at its first annual meeting last month at the Hotel Statler, Detroit, Mich.

O. W. Loudenslager, manager of the research and development department, Goodyear Aircraft Corp., presented a talk on "Properties, Processing, and Uses of Metal-Bonding Adhesives" which covered in detail the thermosetting types of adhesives and featured a description of the company's Bondolite, a sandwich material consisting of a lightweight core material with metal skins.

John H. Gerstenmaier, manager of the development department, molded and extruded goods, at Goodyear's St. Mary's plant, described the "Bonding of Metal to Rubber." He detailed various methods of obtaining adhesion to all types of metals and discussed the alteration of designs to obtain sufficient adhesion. Mr. Gerstenmaier also covered the subject of expected bond loads under various operating conditions with different cores of rubber, synthetic, and metals.

New Nickel Plating Process

General American Transportation Corp., Chicago, Ill., announced the development of a new process for nickel plating at a press luncheon on March 16 at the Plaza Hotel, New York, N. Y. Named Kanigen, the process greatly stretches the available nickel supply and provides other advantages that are expected to make it a major industrial development, it is claimed by the manufacturer.

A catalytic chemical immersion process that requires no electrolytic equipment, Kanigen permits the plating of almost any solid material with a non-porous, uniform, predictable thickness of nickel. The nonporosity of the plating is such that one-third to one-half the thickness of platings deposited by other processes is needed for equivalent protection. Kanigen is said to nickel plate any article uniformly, regardless of shape or size, and to provide a finished plate that has excellent adhesion and other physical properties. The process has proved satisfactory for production line plating of steel, copper, brass, bronze, stainless steel, and aluminum. Tests on thermosetting plastics and magnesium have also given good results. Since the immersion is made at temperatures of 210-212° F., the process is not considered satisfactory for thermoplastics.

The company is building new plants at East Chicago, Ind., and Los Angeles, Calif., to utilize the new process. These plants are expected to be in operation late this year. Thereafter, Kanigen will be licensed to other firms for use in both defense and civilian applications.

Swimming Accessories

A new line of swimming accessories marketed by Martin Rubber Co., Long Branch, N. J., includes the King Neptune fins and masks. Made of natural gum rubber in an attractive sea green color, the swim fins are adjustable to fit all sizes, and the goggles are made of unbreakable glass. Both items are packaged in colorful boxes, which can be used for pop-up counter displays.

Robert C. Toth

Toth Joins IRW Staff

Robert C. Toth has joined the staff of India RUBBER WORLD as an assistant editor. A 1952 graduate in chemical engineering of Washington University, St. Louis, Mo., Mr. Toth had been doing development work at U. S. Army Ordnance Picatinny Arsenal, Dover, N. J. He served two years in the Marine Corps before entering Washington University.

Mr. Toth will assist the present editors with the increased volume of editorial work involved in the publication of India RUBBER WORLD and the bound volumes of "Machinery and Equipment for Rubber and Plastics" and "Compounding Ingredients for Rubber."

New Acrylic Monomer Plant

The completion and the operation of a new plant for the production of acrylic monomers and raw materials used in the manufacture of the company's plastic materials have been announced by Rohm & Haas Co., Philadelphia, Pa. (An entirely new process is reportedly being used which employs as its raw materials acetylene, carbon monoxide, and various alcohols.) The new plant, at Deer Park, Tex., represents the second $8,000,000 expenditure of the company at this installation where two years ago it erected a plant for the manufacture of hydrogen cyanide.

Redeems Preferred Stock

American Cyanamid Co., 30 Rockefeller Plaza, New York 20, N. Y., on March 4 announced that its outstanding convertible preferred stock, Series A (approximately 14,000 shares), has been called for redemption on April 15.

In the meantime, up to the close of business on April 13, holders of this preferred stock have the right to convert such shares into common stock on the basis of $21.25 per share: each share of preferred stock, Series A, may be converted into 4.7 shares of common (four full shares and a scrip certificate for $^{7}/_{10}$ of a share).

The market value of 4.7 shares of common stock, at the recent price of $48⅝ per share, is approximately $228; whereas the redemption price for one share of preferred is only $103.64583 per share.

3-D Movie Screens

A series of dual-purpose projection screens for third-dimensional movies or "daylight" showings in the classrooms or homes has been developed by the Glometer Corp., Buffalo, N. Y. Constructed of a laminated sandwich made up of Ultron vinyl and Vuepak acetate, products of Monsanto Chemical Co., Springfield, Mass., the Magniglow screens are approximately the same thickness as conventional ones. The manufacturing process of the Ultron-Vuepak combination, for which patent applications have been made, has been adapted to mass production at a cost reputed to permit competitive pricing of the new screens with conventional types.

Sun's Anniversary Line

Sun Rubber Co., Barberton, O., unveiled its thirtieth-anniversary line of Sunbabe dolls early in March. Heading up the line is an 11-inch "Peter Pan" doll made of soft, squeezable plastic and styled in accordance with the Disney movie character. Two other new numbers are "Bob" and "Bobbie," a new set of 14-inch tall twin boy-and-girl dolls with Sunskin latex bodies, voice, and lifelike plastic eyes. Three complete doll sets are featured in the line. The Sunbabe "Buttons and Bows" sewing set consists of a new 12-inch "Betty Bows" rubber doll with vinyl head, packaged with a complete sewing set in a fitted carrying case. Other sets include the "Babee Bee" doll with a complete layette in a carrying case, and the "Cindy Lee" doll with feeding and formula making accessories. Other longtime favorite Sunbabe dolls are also featured in the anniversary line, as well as two innovations: the inclusion of a guarantee with every item; and a "dress up" policy under which dolls are dressed in appropriately styled garments.

Commenting on Sun's anniversary, T. W. Smith, Jr., company president, noted the original plant had 15 employes and occupied 15,000 square feet of floor space. Sun's present modern plant has approximately 250,000 square feet of floor space and employs more than 1,300 men and women. The company buys its own rubber, does its own compounding and processing, develops its own molds, and has a complete pilot-plant to produce new models. The processes and equipment by which the company's vinyl toys and dolls are made are covered by recently issued patents.

Barco to Chicago Suburb

After 45 years in Chicago, Ill, Barco Mfg. Co., according to President F. N. Bard, is transferring all manufacturing and business operations to Barrington, Ill., where the company has erected a new ultra-modern 103,000-square-foot plant.

Long a prominent producer of railroad equipment and flexible joints for piping in industry, Barco, in more recent years, has broadened its line to include speed recorders for diesel locomotives, portable gasoline soil tampers (Rammers) and gasoline powered hammers for builders and contractors, and a new line of revolving joints for textile, paper, and other mill equipment.

In Barrington, a suburb 45 miles northwest of Chicago, the new Barco plant is at 500 N. Hough St. It is planned for efficency in manufacturing, with all operations on one floor.

Calco Safety Award

A record of 6,985,294 man-hours worked without a lost-time accident, which may set a new national safety mark for the coal-tar industry, has won for the Calco Chemical Livision, Bound Brook, N. J., the "President's Award" of the parent American Cyanamid Co. Made between March 6, 1952, and February 3, 1953, the new safety mark will be commemorated by a plaque to be presented to the Bound Brook plant in May.

Dayton's Nu-Ride Service

A new service applicable to all wheel and tire assemblies to provide a smoother ride has been announced by Dayton Rubber Co., Dayton, O. Called the Dayton Nu-Ride Service, the process utilizes a series of newly developed precision machines and adjustments to eliminate wheel vibrations. In addition to completely balancing a vehicle's wheel and tire assemblies, the service also makes tires truly circular. While details are not available as yet, it is understood that precise roundness of tires is accomplished by means of a special buffing machine. The Nu-Ride Service is being made available through Dayton dealers all over the nation as soon as training of technicians can be completed.

New Sunbabe Dolls in Sun Rubber's Anniversary Line Include (*L.* to *R.*) "Bobbie" and "Bob" Twns, "Betty Bows," and "Peter Pan"

Fidelity Realines Top Staff

The Fidelity Machine Co., Inc., Philadelphia, Pa., manufacturer of specialized equipment for the textile, rubber, and wire industries, on March 10 announced a realinement of its top executive staff to speed its expansion drive into new markets.

Lawrence Katz, chairman of the board, has assumed active leadership of the company. Though he has headed the Fidelity organization for the past seven years, his work until now has been confined to an advisory rather than a participating nature. The change, he indicated, is being made because of Fidelity's need of day-to-day coordination of its expanding domestic and foreign activities.

"We are faced," he said, "with a large volume of military work, a healthy demand for our products in the markets which we now serve, and we have several new products which we are about to introduce in new markets. This, coupled with a steadily growing business abroad, makes apparent the need of full-scale leadership."

Joseph P. Vogt, Fidelity president, besides his administrative duties as general manager, is assuming charge of all new product development and engineering, and a newly created product development division has been set up under his direction to seek new patents and inventions which can be successfully marketed and to handle the development of Fidelity's own products.

Roy Faigenbaum, newly announced vice president for sales, now heads the market development division, which will study the existing application of Fidelity products in the domestic markets and make recommendations of new uses and fields suitable for the company's equipment.

Robert Scholes, as vice president in charge of engineering and production, will have complete supervision of the plant and the constant improvement of engineering and manufacturing methods for both quality and production.

Moor Gro-Cord President

Gro-Cord Rubber Co. Lima, O., at its thirty-fourth annual meeting, March 7, elected Forest Moor president to succeed Fred W. Cook, who was made chairman of the board.

All other company officers and directors were reelected as follows: Harold Smith, first vice president and assistant treasurer; Winston L. Hunt, secretary-treasurer; Melvin C. Light, assistant secretary; J. S. McKindsey, vice president and sales manager; directors, Virgil M. Knisely, Rodney P. Lien, and Messrs. Cook, Light, Moor, and Smith.

Both Cook and Moor were simultaneously elected to the same positions in the company's wholly owned subsidiary, Gro-Cord Rubber Co., of Canada, Ltd., Tillsonburg, Ont., Canada.

Mr. Cook has been associated with Gro-Cord as an officer and a director since its inception in 1920. He was treasurer for 20 years prior to his election to the presidency in 1939.

Mr. Moor has been actively connected with the company for 10 years. A director for the past eight years, Mr. Moor was vice president and general manager prior to army service. Upon his return to civilian life he held the position of Gro-Cord secretary-treasurer until he was made vice president and general manager on September 1, 1951. He is also a director of the Rubber Heel & Sole Institute and a director and treasurer of Elastic Colloid Research Corp.

Toy Fair's Golden Jubilee

The fiftieth annual American Toy Fair of the Toy Manufacturers of the U. S. A. was held in New York, N. Y., March 9-18, and included more than 1,250 displays designed to emphasize the educational as well as the recreational features of toys. The 12 acres of space required to house the show included nine floors each at the New Yorker and McAlpin hotels, and permanent exhibits at 200 Fifth Ave., 1107 Broadway, and other locations. The toy prices were reported to be equal to or below those of the past year, and the $400,000,000 sales record for 1952 is expected to be broken this year.

Rubber and plastic items again appeared popular with the younger set, as evidenced by the quantity displayed. As in past years, rubber and plastic manufacturers featured dolls, vinyl inflatables, rubber masks, balls, and puppets as well as all types of molded plastic toys.

Among those firms which exhibited rubber masks were Bayshore Industries; Lee-Tex Rubber Products Corp. of California; National Mask & Puppet Corp.; and Topstone Rubber Toys Co., Inc. Balls and balloons were displayed by Barr Rubber Products Corp.; Eagle Rubber Co.; Fli-Back Sales Corp.; Marshall Rubber Co.; Oak Rubber Co.; Pioneer Rubber Co.; Seamless Rubber Co.; Serugo Rubber Co.; Tillotston Rubber Co.; and Van Dam Rubber Co. Dolls were seen at the booths of Arcadia Doll Co.; Auburn Rubber Co., Inc.; Natural Doll Co.; and Sun Rubber Co. Swimming accessories were shown by Aquapruf Division, E-Z Products Co., and Healthways, Inc.

Vinyl inflatables, including beach balls, wading pools, beach mattresses, and play balls, were exhibited by Bilnor Corp.; Clarvan Corp.; Davis Products, Inc.; Doughboy Industries, Inc.; Kestral Corp.; Liberty National Corp.; Molded Latex Products, Inc., Plastic Heat Sealing Co.; Plastikaire Products, Inc.; and U. S. Fiber & Plastic Corp. Molded plastic toys were featured at the displays of Archer Plastics Co.; Atlantic Plastics Co.; Aurora Plastice Co.; Champion Plastics Corp.; Dewey & Almy Chemical Co.; Dillon-Beck Mfg. Co.; Ideal Toy Corp.; Noma Electric Corp.; Nosco Plastics Corp.; Palmer Plastics, Inc.; Pilot Plastics, Inc.; Plasticraft Mfg. Co.; Plast-O-Matic Corp.; and Thomas Mfg. Corp.

One of the interesting features of the show was a demonstration by Dow Chemical Co. of the characteristics of Styron 475 and its applications in the manufacture of plastic toys.

New Republic Sales District

The formation of a new southwest district of the Republic Rubber Division, Lee Rubber & Tire Corp., Youngstown, O., was announced last month by G. L. Smith, Republic's sales manager.

W. T. Willey, field representative in Houston, has been appointed district manager, with headquarters in Tulsa, Okla.

Other members of the new district sales organization who will be responsible for the sale and service of Republic's belting, hose and packing are: R. I. Cravens, who will headquarter in Dallas; D. L. Cushing, in Houston; and R. E. McQuiston, in Midland, Tex.

Mr. Smith cited the tremendous increase in both industrial and petroleum activities in the Southwest as the principal reason for Republic's decision to add personnel and sales direction in the area.

Timken Expansion Program

A. L. Bergstrom, vice president in charge of engineering at The Timken Roller Bearing Co., Canton, O., has announced a multi-million dollar expansion program for the company's Bucyrus, O., plant.

A new toolroom will be built to house the maintenance, repair, electrical, sheet metal departments, and all stores. This building will be 100 feet wide by 220 feet long with a clearance under the trusses of 16 feet. Attached to the toolroom will be an office building 40 by 100, providing space for the plant management, accounting, personnel, and medical departments.

A locker room and cafeteria building will be constructed. The former will have facilities for 850 employes, and the cafeteria will have a seating capacity of approximately 150. The total area of this building is about 8,000 square feet.

An important part of the program is a new boiler plant. When the first production line at Bucyrus was started, it was decided to heat the building with oil heaters. As the plant has increased in size, oil heat has become uneconomical, and a complete boiler plant will be built which will supply steam for heating as well as for process purposes. This plant will be designed for a capacity of 80,000 pounds an hour. The two boilers will be provided with three alternate methods of firing—coal, oil, and gas.

Cost of all these plans is estimated at approximately $1,250,000.

New machinery and production equipment for the manufacture of bearing parts will be installed at Bucyrus and should be in full production by the end of 1954. Bergstrom also said that green machining facilities will be provided for five proposed production lines. Grinding, honing, inspection, assembling, and all necessary equipment to complete one of the bearing parts' manufacturing lines will be installed soon.

The cost of the new manufacturing equipment for this project will be about two million dollars. Timken officials estimate that the construction program can be completed by the end of this year. The proposed production facilities are expected to be in full operation by the end of 1954

Pottenger Promoted

Carl H. Pottenger, since 1948 assistant sales manager, chemical division, Koppers Co., Inc., Pittsburgh, Pa., has been promoted to assistant vice president and division sales manager, succeeding T. C. Keeling, Jr., who resigned to become president of the hydrocarbons division of Mathieson Chemical Corp.

J. W. Pool, Jr., has been named assistant sales manager of the chemical division. He formerly was its chemical products manager.

Mr. Pottenger entered business as a research chemist for the Bell Telephone Laboratories and later did sales development work with several chemical firms. In 1946 he became a vice president of Pennsylvania Coal Products Co., a company later purchased by Koppers. In 1947 he was appointed assistant manager of the plastics department of American Cyanamid Co., but returned to Koppers in 1948 as assistant sales manager, chemical division.

Mr. Pool joined Koppers in 1942 as general foreman of its butadiene division. Following the war, he came to the Pittsburgh offices of the chemical division, serving first as Pittsburgh district sales manager and then as chemical products manager.

C. T. Burgess

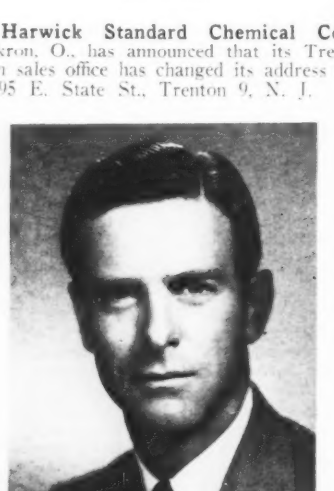
Emery Sales Changes

Among recent changes in the chemical sales staff of Emery Industries, Inc., Cincinnati, O., is the shift of J. P. Clancy from the southern area to New England. He will join J. M. Washburn in the responsibility for sales of all Emery products, including fatty acids and derivatives, Plastolein plasticizers, and Twitchhell textile oils, in the New England area.

C. T. Burgess will take over the sales duties vacated by Mr. Clancy, which involves the states of Mississippi, Alabama, Georgia, and the eastern section of Tennessee.

Two additional men, E. L. Spencer and E. W. Sack, were appointed to the sales staff. Mr. Spencer was formerly with Cincinnati Chemical Works. Mr. Sack was transferred from Emery's production department, where he served as a department supervisor for the past 11 years. Both will assume field sales responsibility in the near future.

Harwick Standard Chemical Co., Akron, O., has announced that its Trenton sales office has changed its address to 2595 E. State St., Trenton 9, N. J.



Willard Stewart, Inc.

H. Logan Lawrence

Eagle-Picher Elections

At the annual meeting of shareholders of The Eagle-Picher Co., Cincinnati, O., Gen. Hermon F. Safford was elected a vice president and a director. Safford is president of the Ohio Rubber Co. Willoughby, O., a division of Eagle-Picher.

Reelected directors for the coming year are: Joel M. Bowlby, William R. Dice, Carl A. Geist, Carl F. Hertenstein, Elmer Isern, Stanley R. Miller, William H. Mitchell, John J. Rowe, T. Spencer Shore, George A. Spiva, and Miles M. Zoller.

Officers reelected are: Mr. Bowlby, chairman of the board; Mr. Shore, president; Mr. Dice, vice president and comptroller; Mr. Geist, vice president, secretary, and treasurer; Messrs. Isern and Zoller, vice presidents; and Richard Serviss and K. E. Kimmel, assistant secretaries. John H. Winchester, of Ohio Rubber, was also elected assistant secretary.

More Epichlorohydrin to Come

Shell Chemical Corp., New York 20, N. Y., according to Jan Oostermeyer, president, has completed a threefold expansion in the productive capacity of its epichlorohydrin plant at Houston, Tex. Epichlorohydrin is a major component of epoxy resins and is also used in adhesives, chemical intermediates, and insecticide stabilizers. The raw material used for production is allyl chloride, of which Shell Chemical is the major producer. A part of the new epichlorohydrin production will be tied in with the expansion of the company's facilities for manufacturing Epon resins, now in tight supply. Shell Chemical's new bisphenol and Epon resin plants at Houston are expected to be in production next fall and to relieve the resin shortage.

Du Pont Advances Two

Two promotions were announced March 24 by the rubber chemicals division of E. I. du Pont de Nemours & Co., Inc., Wilmington, Del. H. Logan Lawrence was transferred from Boston to Wilmington to assume the newly created position of assistant sales manager for neoprene. F. Herman Fritz, Jr., was shifted from Wilmington to Akron to become manager of the company's rubber laboratory there.

Mr. Lawrence in 1934 started in the company's industrial engineering division at Deepwater Point, N. J., was transferred in 1936 to the rubber chemicals division for neoprene synthetic rubber sales promotion work, in 1941 was assigned to the rubber laboratory at Deepwater Point in the tire development group, and in 1946 was recalled to Wilmington to become assistant sales manager of the export sales section. Mr. Lawrence was transferred to the Boston district office of the organic chemicals department in 1949 and from 1951 on was sales supervisor for the rubber chemicals division in that office.

Mr. Fritz in 1943 joined Firestone Industrial Products Co., Noblesville, Ind., where he did development work on molded rubber products. In 1948, following a year in the U. S. Navy, Mr. Fritz went with du Pont as a chemist-compounder in the mechanical rubber goods division of the rubber laboratory at Deepwater Point. He was engaged in development of compounds and technical sales service work, both here and abroad. He has also made a number of contributions to the technical literature on rubber.

J. P. Clancy

Soda Ash, Chlorine Prices Up

Diamond Alkali Co., 300 Union Commerce Bldg., Cleveland, O., has announced price increases for soda ash and chlorine on shipments made on or after May 1. Light and dense carload soda ash will be priced 15¢ higher per 100 pounds. Chlorine prices will rise 20¢ per 100 pounds in single-unit tank-car deliveries; in multi-car deliveries, the price is dependent upon the quantity purchased annually.

Renaming of Subsidiary

Diamond Alkali also announced that the name of its subsidiary, Kolker Chemical Works, Inc., has been changed to Diamond Alkali Organic Chemicals Division, Inc. The subsidiary, purchased in August, 1951, manufactures organic chemicals for agriculture and industry at its plants in Newark, N. J., and Houston, Tex.

Barrett Division, Allied Chemical & Dye Corp., New York, N. Y., has acquired the Greensboro plant of Synvar Southern Corp. The same grades of urea-formaldehyde resins as were previously supplied by this plant to Synvar's customers in the furniture and textile industries will continue to be produced at the plant.

F. Herman Fritz, Jr.

General Tire Promotes Several

The General Tire & Rubber Co., Akron, O., has announced a number of personnel changes in its field credit and office organization.

Hoyt H. Hendricks has been promoted from office and credit manager of the Atlanta division to credit manager for the southern region with headquarters in Dallas.

Conrad Uhrich, former district credit manager for the Chicago, Twin City, and St. Louis divisions, has been named credit manager for the west central region. He will continue his headquarters at Chicago.

Edward M. Gillies, formerly of the credit department, eastern region, has been appointed office and credit manager for the company's Atlanta sales division.

John E. Niess has been advanced from the credit department of the Chicago division to office and credit manager of the Kansas City division.

Paul J. Churchwell, office manager of the Houston division, has been made office and credit manager of the San Francisco division.

Two important changes in its field credit organization have also been announced by General Tire.

William G. Heddesheimer, Jr., office and credit manager of the Memphis division since 1948, has been named regional credit manager with headquarters in Chicago, where he will supervise credit operations for the Chicago, Twin City, St. Louis, and Kansas City divisions.

Replacing him in Memphis is William A. Bott, from the company's credit department in Akron.

Heddesheimer, has been with General his entire business career. Before going to Memphis, he was in the firm's New York and Philadelphia offices.

Bott joined General Tire in 1951 as a trainee and has been employed in the credit department for the past year.

New Sales Representatives

General Tire has appointed The C. P Hall Co., Akron, exclusive sales agent for its rubber-to-metal adhesive Kalabond, in the entire United States except California, Oregon, and Washington.

W. Glenn Wunderley, of Pasadena, Calif., has been named exclusive sales agent in those three states for the following products manufactured by General Tire's chemical division: Gen-Tac Latex, vinyl pyridine latex; Gen-Tac Resin, water-soluble phenol-formaldehyde resin; Ko Blend I. S., latex-compounded masterbatch of insoluble sulphur in GRS; Kalabond; Actogen, accelerator activator; and Polystop, GRS polymerization shortstop. Wunderley, one-time sales manager of Fisher Scientific Co., has represented several concerns on the West Coast since 1945.

Bliss Succeeds Rice

Appointment of Howard Bliss as sales manager of the Pennsylvania Athletic Products Division was announced last month by J. E. Powers, general sales manager of plastics and special products of General Tire. Bliss succeeds Harry Rice, who has resigned.

Former assistant manager of the division, Bliss has a broad background in athletic work. He joined the Pennsylvania division in 1950 as midwest sales representative and was assigned to the Akron office last year as assistant manager.

Vinyl Film by Blow Extrusion

The development of a new transparent polyvinyl chloride film, made by the blow extrusion process, has been announced by General Tire. The film, called X-V, is processed in sheets 36 and 72 inches wide and is available in a thickness range of 0.001-0.004-inch in folded sheet or tube form. It is manufactured in a variety of colors and claims as outstanding features high tear strength and light weight. Resistance to acid, flame, grease, and dimensional changes are other properties of the material, which suggest its applicability to packaging, liners, and other commercial and industrial uses.

Seamless Buys D & A Dip Goods Division

The Seamless Rubber Co. New Haven, Conn., manufacturer of hospital goods, athletic equipment, industrial tape, and rubber specialties, has purchased the dip goods division of Dewey & Almy Chemical Co. Cambridge, Mass., except for a few items not compatible to the Seamless line.

The addition of the Dewey-Almy division is expected to add substantially to the volume of sales of bladders for athletic goods, recoil pads for guns, waders, parkas, beach balls, and other recreation and sports equipment, it was announced by F. Thatcher Lane, president of Seamless.

The latest step in the expansion of Seamless will add from 100 to 200 employes to the company's payroll at the New Haven plant, according to Arthur R. Gow, executive vice president.

"The moving of operations to our own plant is expected to provide us with the most modern rubber dipping equipment in the United States," said Mr. Gow. "We expect to begin moving the equipment from Cambridge to New Haven just as soon as we can complete arrangements."

The new facilities will be used to augment the complete line of athletic goods sold by Seamless, which includes bladders, basketballs, footballs, volley balls, handballs squash balls, home and pitchers' plates, hockey pucks, soft balls, tennis balls, golf balls, athletic tape, and bathing caps.

Promoted by 3M

Charles A. Kelley has been advanced to general sales manager of the adhesives and coatings division of Minnesota Mining & Mfg. Co., St. Paul, Minn. He had previously served as division sales manager for the automobile industry and has been on the 3M sales staff since 1940. In his new position Kelley will continue to headquarter in the firm's Detroit office.

The adhesives and coatings division recently named Alvin O. Fuhrmann to sales manager for industrial and distributor trades, with headquarters in Detroit.

Voit Rubber and Jalopies

Southern California's top jalopy drivers, as selected from their 1952 performances by the California Jalopy Association, were honored with an awards presentation banquet on February 28. The six winning drivers were given trophies donated by W. J. Voit Rubber Co., Los Angeles, Calif., and the A-1 Tire Service.

Voit was in turn honored on March 15 by a special "Voit Rubber Corp. Day" held by the Association to commemorate the corporation's activities in sponsoring many cars and drivers in past seasons' competition.

U. S. Opens New Branch

United States Rubber Co., Rockefeller Center, New York 20, N. Y., on March 11 formally opened its new Charlotte, N. C., branch and tire distributing center at 3330 Monroe Rd., with many distributors from the Carolinas in attendance and also a number of high company officials from New York.

Among those present were: Wilson O. Green, general sales manager of the company's tire division, his assistant, D. B. Eldred; W. A. Mitchel, assistant manager of distributing branches; H. C. Oliver, sales manager, U. S. Tires; J. E. Kennedy and C. A. Ostrom, assistant sales managers, U. S. Tires; W. J. Palmer, eastern division manager; C. H. Shirley, advertising manager, U. S. Tires; Carl G. Knarzer, assistant traffic manager; and George M. Mayernik, of the tire division.

H. N. Roberts, district manager of tire sales, and T. R. Ronan, branch operations manager, are in charge of the new branch, an outgrowth of the one founded in Charlotte in 1937.

Clark and Weigold Advanced

Thomas E. Clark has been appointed engineering consultant for the tire division, with headquarters in New York. Mr. Clark was factory manager at the company's Chicopee Falls, Mass., plant since 1943, where he has been succeeded by Harold Weigold, assistant factory manager at the Detroit tire plant.

In his new position Mr. Clark will work with the company's five tire plant engineers on the most effective use of equipment. He started with the rubber company in 1921 and subsequently became factory manager at the Indianapolis tire plant, and at a Charlotte, N. C., shell loading factory operated by the company during the war.

Mr. Weigold joined U. S. Rubber in 1919. Prior to becoming assistant factory manager at Detroit, he held a similar title at Charlotte and at Eau Claire. He has also worked at Providence and Hartford for the company.

Outcault Retires

St. Joseph Lead Co., 250 Park Ave., New York 17, N. Y., on March 2 announced that Harry E. Outcault, manager of zinc oxide sales, has exercised the early retirement privilege under the company's retirement plan for salaried employees. In view of Mr. Outcault's retirement, the zinc oxide sales department has been consolidated with the metal sales department.

Charles R. Ince, vice president and manager of metal sales, becomes vice president and sales manager. Malcolm Bonynge and Dwight Marshall continue as assistant sales managers in the metal sales department; while Robert H. Crossley has been made assistant sales manager in charge of zinc oxide sales. Under the above consolidation no changes in sales outlets or method of distribution are contemplated.

The Bell Mineral Corp., supplier of Oxford grades of feldspar, with a plant at West Paris, Me., was incorporated in January, 1953, with Richard Bell as president and W. Wallace Roff as vice president. The new corporation has appointed Whittaker, Clark & Daniels, Inc., 260 West Broadway, New York 13, N. Y., as its eastern sales representative.

Low-Pressure Casing

The successful completion of preliminary tests on a new type of very low-pressure watermelon-shaped tire has been announced by the Goodyear Tire & Rubber Co., Akron, O. Invented and designed by W. H. Albee, the Rolligan is made of one-ply rubberized fabric topped by a ¼-inch layer of gum-rubber treated stock. It is operated with an air pressure of 1½-5 psi.; and although it has an axle to hold it in position, the Rolligan is driven not by the axle, but by a series of rotating rollers on the underside of the carriage which rub against the top surface of the tire and cause it to roll.

The construction of the Rolligan reportedly permits safe and comfortable driving over rough and swampy ground because of the extreme pliability of the thin walls which conform to the shape of any obstruction over which they pass. Its design permits even distribution of the weight of the vehicle over the entire area of contact with the ground. Wide application in the military and agricultural fields is anticipated.

Modified Jeep Fitted with Low-Pressure Tires Rolling over Inventor Albee

Goodyear Appointments

R. B. Warren has been named manager of Goodyear's industrial products departments at Akron.

L. W. Adams has been promoted to Warren's former post as southern sales manager, industrial products division.

Warren joined Goodyear in 1927, in 1933 became an industrial products field representative in Atlanta, Ga., and transferred to New York in 1938. He served as assistant head of the Navy rubber director's office from 1942 to 1945. Then Warren was industrial products district manager at Pittsburgh until 1949 before becoming southern sales manager.

Adams, Pittsburgh district manager for the industrial products division since 1949, joined the company in 1943 as an industrial products clerk and later that year was assigned to the Boston district as a field representative.

Samuel J. Mabry has been appointed Atlanta district manager for the division. Mabry, an industrial products representative for Goodyear at Los Angeles since 1948, replaces John E. Ragan, deceased. Joining Goodyear as a production worker in 1935 at Los Angeles, Mabry became associated with the industrial products division in 1945 as an order clerk, he was appointed office manager in the division office at Los Angeles in 1947, and took field representative training in 1948.

W. Raymond Myers has been appointed assistant manager of original equipment sales in the metal products division at Goodyear. He had joined the company as a sales engineer in the rim division in 1946.

George H. Effland, manager of trade sales for the rim division, continues in that capacity as manager of service sales for the metal products division, formerly the rim division. Effland has been with Goodyear since 1928, when he started as an apprentice machinist. He was made a machinist in the rim plant in 1937 and in 1947 became manager of trade relations.

Aircraft Wheel and Brake Clinic

The fifth annual Wheel and Brake Clinic was recently held by Goodyear for the purpose of discussing the wheel, brake and tire problems of the aircraft industry today and in the future. The 60 attending engineering representatives from all phases of the industry, including the military, witnessed the production of plane tires, wheels, and brakes at the Goodyear facilities. The two-day clinic was planned by E. M. Eickman, manager of the company's aviation products division, and featured a talk by E. J. Thomas, Goodyear's president, and a banquet at the Mayflower Hotel, Akron.

Annual Refresher Clinic

The annual conference of Goodyear's district managers and flooring sales representatives from all sections of the country was recently held in Akron. The meeting included trips through the production and research and development facilities of the company as well as conferences on future programs.

Heads of the various divisions of the flooring sales department assisting the manager, H. M. Evans, in presenting the four-day program included: E. F. Murphy, flooring sales development; A. W. Biggs, contract sales; and R. H. Kilgore, field sales.

Those attending received an advance look at new corrugated rubber matting and residential gage rubber flooring to be marketed by Goodyear, as well as information on the company's latest developments in the vinyl flooring lines. The corrugated matting, described as one of the highest quality manufactured, is made in two colors. Of ⅛-inch gage and in widths of 24, 36, 48, and 72 inches, the matting can be supplied in full rolls of 50 linear yards, or half rolls of 25 linear yards.

Public Relations Award

Goodyear has received an award from the American Public Relations Association "for meritorious public relations performance in the field of transportation" as a result of the company's Better Roads Campaign. A Silver Anvil Trophy signifying the award was presented to V. Y. Bell, fleet sales manager, tire division of Goodyear, by T. J. Deegan, Jr., chairman of the Association's judging committee, at a recent luncheon in Washington, D. C.

Monsanto Chemical Co., Springfield, Mass., plans to increase its capacity for the production of formaldehyde by 50%. New facilities which will be constructed at Springfield are expected to begin operations early in 1954.

John Stearns Johnson, assistant to the president of United States Rubber Co., has been elected a director of National Co., Malden, Mass.

Timken Promotes Two

S. C. Partridge, general manager, industrial division, The Timken Roller Bearing Co., Canton, O., has announced the appointment of Robert G. Morgan as district manager, Moline, Ill., office, and Robert L. Williams, district manager, St. Thomas, Ont., Canada, office.

Morgan, who started with Timken in 1937 as an engineering trainee, assumes his new position after having served in the automotive division, industrial and automotive sales order department, and as district manager at St. Thomas.

Williams also began as an engineering trainee at Timken, in 1938, and in 1940 was assigned to the Cleveland office as a field engineer. In 1943 he entered the United States Navy, where he served until 1946.

Employe Benefits

J. M. Huber Corp., 100 Park Ave., New York 17, N. Y., has announced the payment of $1,200,000 out of 1952 earnings to its 1,250 employes under profit sharing and retirement plans.

The company owns and operates 507 producing oil and gas wells in this country, with 53 new wells having been drilled in the past year. A new plant at Havre de Grace, Md., which produces a white chemical pigment known as Zeolex 20, has been erected to complement the company's line of chemicals, carbon black, kaolin clay, and printing inks.

Goodrich at Packaging Show

The exhibit of B. F. Goodrich Chemical Co., Rose Bldg., Cleveland, O., at the American Management Association's National Packaging Exhibition, which will take place in Chicago on April 20-23, will feature a display of rodent repellent test boxes coated with a dispersion of Goodrite z.a.c. This material is claimed to have been proven effective in repelling rats in tests conducted by the Fish & Wildlife Service of the United States Department of Interior.

Other new packaging applications of the company to be displayed at the show include Geon vinyl plastic covers, tapes made with Hycar rubber adhesives, and Hycar rubber-phenolic plastic shipping cases.

NEWS ABOUT PEOPLE

Turner Alfrey, Jr.

Waldo B. Burnett

Turner Alfrey, Jr., has been appointed assistant director of the physical research laboratory of The Dow Chemical Co., Midland, Mich. Prior to joining the company in 1950, he was a professor of polymer chemistry at the Polytechnic Institute of Brooklyn, where he took his Ph.D. degree in 1943, and was also assistant director of that institution's Institute of Polymer Research. He held a visiting professor's chair in polymer chemistry at Liege, Belgium, in 1947. Previously he had been with the Monsanto Chemical Co.'s plastics division. Dr. Alfrey is the author of one book and co-author of two others on polymer chemistry as well as the author of a number of papers, mainly in the high polymer field. In his new position he will work directly with W. C. Bauman, director of the physical research laboratory.

Ernest C. McDonald, Jr., has been made head of the new technical service laboratory of The Georgia Marble Co., calcium products division, Tate, Ga. Mr. McDonald spent three years in lead and zinc pigment production control for Eagle-Picher at Galena, Kans., four years in the Devoe & Reynolds laboratories at Louisville, Ky., and was in charge of the paint and varnish research for Eagle-Picher at Joplin, Mo., for the last two years. The new facility of Georgia Marble, now under construction, is expected to begin full operation soon. Besides customer relations and problems, the new laboratory will take over and expand the present quality controls to assure the finest wet and dry ground extenders, whitings, fillers, and inerts for the paint, plastic, rubber and floor covering industries.

William McNear Rand has resigned as a member of the board of directors and of the finance committee of Monsanto Chemical Co., St. Louis, Mo. The action was made necessary by confirmation in the U. S. Senate on March 11 of Rand's appointment as deputy director of the Mutual Security Administration. President Eisenhower announced his appointment as assistant to MSA Director Harold E. Stassen on February 20. Rand retired as president of Monsanto in May, 1951.

Waldo B. Burnett, for the past seven years director of the University of Wichita Foundation for Industrial Research, has been appointed technical director of United Carbon Co., Inc., the carbon black division of United Carbon Co., Charleston, W. Va. Dr. Burnett is visiting all the company's carbon black plants, and he will have his headquarters in Charleston. Dr. Burnett started on the staff of Mellon Institute, where he served first as industrial fellow. During this period, 1923-1939, he engaged in research on rubber accelerators, antioxidants, stearic acid, naval stores, gluconic acid, plastics, and various aspects of rayon technology. In 1939 he joined Tubize Rayon Corp. as assistant director of research and development. After progressing to director of research and development and to director of viscose operations, he left Tubize in November, 1945, for the University of Wichita Foundation for Industrial Research, where work on several extensive research projects has been conducted for United Carbon during the past few years. Dr. Burnett holds memberships in the American Chemical Society, American Institute of Chemical Engineers, Society of Automotive Engineers, Society for Experimental Stress Analysts, American Association of Textile Chemists & Colorists, American Association of Cereal Chemists, Institute of Food Technologists, and the American Marketing Association.

Vlon N. Morris has been appointed executive secretary of the council of research directors of Johnson & Johnson companies. Dr. Morris recently was director of research for Shellman Products and previously had served in a similar capacity at Industrial Tape Corp. Among the responsibilities of Dr. Morris will be that of liaison between the various foreign and domestic research organizations of the combined family of companies of Johnson & Johnson. These include Johnson & Johnson, surgical dressings; Ethicon Suture Laboratories and Industrial Tape, all of New Brunswick, N. J.; Personal Products, Milltown, N. J.; Chicopee Mfg. Corp., Chicopee Falls, Mass.; Ortho Pharmaceutical, Raritan, N. J.; Hughes Autograf Brush Co., Watervliet, N. Y.; and their foreign affiliates.

William F. Talbot has been appointed vice president of Rubberset Co., Newark, N. J., manufacturer of paint brushes, Flomatic paint rollers and lather brushes. Dr. Talbot is in charge of Rubberset's plastic products division at the Salisbury, Md., plant and directs the research and development program of the company. Prior to joining Rubberset, a Bristol-Myers subsidiary, early in 1952, Dr. Talbot served the Chemical Corps of the U. S. Army as principal civilian scientist at Dugway Proving Ground, Tooele, Utah. During World War II, Dr. Talbot was consultant to the Office of Strategic Services and for a time, assistant director of its research and development branch. In 1946 he was head of the newly organized Stanford Research Institute at Palo Alto, Calif., and while in California was also director of the Palo Alto Medical Research Foundation; director and board chairman of the Cooperative Research Foundation; and a director of Beckman & Whitley, Inc. Dr. Talbot holds a number of patents and has published numerous technical articles.

William J. McCarthy, development engineer, has joined the Hycar rubber section, sales development laboratory, B. F. Goodrich Chemical Co., Rose Bldg., Cleveland, O. Prior to joining this company, McCarthy had served for more than nine years with Office of Synthetic Rubber, Washington, D. C., as a field representative and as chief of the Finished Products Unit. A member of the American Chemical Society and its Division of Rubber Chemistry, McCarthy is also present secretary of the Washington Rubber Group.

James K. Lindsay was elected secretary of Heyden Chemical Corp., New York, N. Y., at a board meeting on March 11, to succeed **Paul van der Stricht,** who has resigned. Mr. Lindsay was previously a partner in a law firm.

C. Lynn Frost has been appointed advertising manager of Hewitt-Robins, Inc., Stamford, Conn., responsible for the advertising of all the company's products. Mr. Frost joined Hewitt in 1949 as assistant advertising manager.

William H. Owen has been appointed product manager of the flat belting department of Boston Woven Hose & Rubber Co., Cambridge, Mass. Mr. Owen has been with the concern for the past 2½ years. He is well qualified for his new post because of his work in engineering sales and as conveyor belt engineer of the belting department where he took part in the production of some of the largest conveyor belts ever manufactured. Prior to his association with BWH, he was a sales engineer with C. O. Bartlett & Snow Co.

Leland M. White has been made assistant director of the research and development department of United States Rubber Co., New York, N. Y. Dr. White joined the company's research and development department in 1940 and has been head of the rubber applications department at the Passaic, N. J., general laboratories since 1947. He is succeeded in the latter position by **B. C. Barton.**

OBITUARY

William M. Jeffers

WILLIAM MARTIN JEFFERS, retired president of the Union Pacific Railway and Rubber Administrator in World War II, died at his home in Pasadena, Calif., March 6, after a two-year heart ailment.

Born in North Platte, Neb., January 2, 1876, Jeffers left school at the age of 14.

He started his railroad career as a telegrapher and successively received promotions until he became head of the Union Pacific. It was during the time he was president of the railroad, in September, 1942, that he was appointed Rubber Director by President Roosevelt, entrusted with the job of creating the nation's synthetic rubber industry. After getting the industry to a successful start, Jeffers resigned in September, 1943.

Survivors include three sisters, an adopted daughter, and two nephews.

Funeral services were held in Pasadena, March 10.

Emory W. Stearns

EMORY WARD STEARNS, former president and chairman of the board and a director of Parker, Stearns & Co., Inc., Brooklyn, N. Y. died of a heart attack, March 19.

The deceased was born in Brooklyn, July 23, 1879. He received his education at the Poly Prep. School in Brooklyn and later attended Cornell University, from which he received his B.A. degree in 1902.

He joined Parker, Stearns about 1906. He also was a former owner of Lake Spofford Hotel, Spofford, N. H.

Mr. Stearns was affiliated with Theta Delta Chi, and Kiwanis Club in Brooklyn and also had served as chairman of the Rubber Salvage Committee during World War II. Besides, he was elder emeritus of Roslyn Presbyterian Church.

Funeral services were held at this church on March 21, followed by interment in Nassau Knolls, Port Washington, N. Y.

Besides the widow, survivors include two sons, two daughters, and 10 grandchildren.

Harry L. Mahoney

HARRY L. MAHONEY, advertising and sales promotion manager of The Mansfield Tire & Rubber Co., Mansfield, O., died March 15 after a long illness.

He became associated with the Mansfield organization on May 5, 1947. Previously he had been advertising and sales promotion manager of the associated lines division of The B. F. Goodrich Co. and prior to that had been with Seiberling Rubber Co. and the Goodyear Tire & Rubber Co.

He was born in Akron, March 4, 1904.

Mr. Mahoney was one of the organizers of the Mansfield Advertising club and a member of its board of directors at the time of his death. He also belonged to the Mansfield University club and the First Congregational Church of Mansfield.

Funeral services were conducted in Mansfield on March 17, and internment was at Mt. Herman, Mass.

He is survived by the widow, two daughters, his mother, three brothers, and three sisters.

CANADA

Rubber Stocks Decline

Combined stocks of rubber, natural, synthetic, and reclaim at end of January, 1953, declined to 10,011 long tons from 12,491 on the same date last year; while consumption rose to 7,270 from 6,589, the Dominion Bureau of Statistics reported.

Production of synthetic and reclaim rubber advanced slightly to 7,157 tons from 7,129.

Stocks of natural rubber on January 31, 1953, dropped to 3,887 tons from 4,929 a year earlier; synthetic, to 4,636 from 5,542; and reclaim, to 1,488 from 2,020.

Consumption of natural rubber increased to 2,942 tons from 2,937; synthetic to 3,111 from 2,526; and reclaim to 1,217 from 1,126.

Domestic production of synthetic rubber fell to 6,779 tons from 6,810; while output of reclaim rubber was up to 378 tons from 319.

Barringham's New Officers

At the annual meeting of shareholders of Barringham Rubber & Plastics, Ltd., Oakville, Ont., last month Arnold H. Smith, Leo E. Ryan, and A. Monsaroff were elected to the board of directors. They are president, executive vice president, and vice president of Monsanto Canada, Ltd., respectively.

Other board members named were Felix N. Williams, a director and member of the executive committee of Monsanto Chemical Co.; and Robert K. Mueller, general manager of Monsanto's plastics division.

New officers of Barringham were announced as: Mr. Ryan, president; Mr. Monsaroff, vice president; and J. Jekel, secretary-treasurer. Earl Moffat, appointed general manager, will be the operating head of the company.

Gutta Percha Anniversary

Gutta Percha & Rubber, Ltd., Toronto, Ont., claimed to be the largest all-Canadian manufacturer of industrial rubber products and rubber automotive accessories, celebrated its seventieth anniversary last month.

At the same time the company announced that it had developed a high-pressure, wire braid hose said to be the first of its type to be made in Canada. The new product is reportedly capable of withstanding pressures of nine tons per square inch and temperatures ranging from —70 to 1,800° F.

Polymer's Profit

The Canadian Government's synthetic rubber plant, Polymer Corp., Ltd., Sarnia, Ont., earned a net profit of $2,798,481 in the last nine months of 1952. This figure represents an 8% decrease below the previous year's profit, which was attributed to lower rubber prices and a substantially reduced quantity of chemical sales although sales and production in general were higher than in any previous period. The company ended the year with a surplus of $11,855,720, after paying regular and extra dividends totaling $2,500,000 and after retiring $1,000,000 in oustanding debentures.

The corporation, however, enters 1953 with some misgivings. The expected sale of the U. S. Government's huge synthetic rubber facilities to private industry and the probability of an aggressive sales policy by the purchasers indicate a substantial reduction in future export sales of the Dominion firm. The expected entrance of Germany into the production field is also anticipated as resulting in a further reduction in exports to the European markets.

Stock Swap by Seiberling

Seiberling Rubber Co., Akron, O., has made an offer to exchange its common shares for common shares of Seiberling Rubber Co. of Canada, Ltd., Toronto, Ont. The basis of the offer is two common shares of the Akron company for one common share of the Canadian company.

There are only about 4,000 shares of stock involved in the offer, W. H. Mason, secretary-treasurer, declares, upward of 80% of the 50,000 shares outstanding being held in the United States

Main advantage of the offer to Canadian shareholders, he pointed out, is the relatively higher dividend presently being paid on the parent firm's stock. Dividend is now on the basis of $1 a year, against 25¢ a year on the Canadian shares.

Financial

Philip Carey Mfg. Co., Cincinnati, O. For 1952: net income, $2,264,692, equal to $2.73 a share, contrasted with $2,984,196, or $3.62 a share, in 1951.

Dewey & Almy Chemical Co., Cambridge, Mass. Net income, $657,369, equal to 72¢ a share, against $1,394,602, or $1.53 a share, in the preceding year.

Glidden Co., Cleveland, O. Quarter ended January 31, 1953: net earnings, $1,392,317, equal to 61¢ a share, against $1,366,399, or 60¢ a share, in the 1952 quarter.

Dividends Declared

Company	Stock	Rate	Payable	Stock of Record
American Hard Rubber Co.	$3.50 Pfd.	$0.87½ q.	Mar. 31	Mar. 24
Dayton Rubber Co.	Com.	0.50 q.	Apr. 24	Apr. 10
	Cl. A.	0.50 q.	Apr. 24	Apr. 10
Endicott Johnson Corp.	Com.	0.40	Apr. 1	Mar. 19
	4% Pfd.	1.00 q.	Apr. 1	Mar. 19
Garlock Packing Co.	Com.	0.25 q.	Mar. 31	Mar. 18
General Cable Corp.	Com.	0.15	Apr. 1	Mar. 13
	1st Pfd.	1.00 q.	Apr. 1	Mar. 13
	2nd Pfd.	0.50 q.	Apr. 1	Mar. 13
Goodyear Tire & Rubber Co. of Canada, Ltd.	Com.	1.00	Mar. 31	Mar. 10
	Pfd.	0.50 q.	Apr. 30	Apr. 10
Mansfield Tire & Rubber Co.	Com.	0.40 q.	Mar. 20	Mar. 10
O'Sullivan Rubber Corp.	5% Pfd.	0.25 q.	Apr. 1	Mar. 20

When ordering GR-S Rubbers specify polymers extended with Sundex-53 and Circosol-2XH

Sundex-53 and Circosol-2XH offer you the assurance of polymer uniformity, plus the advantages of the most favorable physical characteristics of the finished vulcanization. Minimum downgrading of the polymers takes place during compounding and long storage of raw polymers when these two Sun products are used as extenders.

SUNDEX-53 is a relatively aromatic process aid. Its plasticizing action provides good processing in Banbury and mill mixing. Sundex-53 is highly compatible with natural rubber, GR-S, reclaims and all combinations of these three.

Oil masterbatch polymers containing Sundex-53

New Number	Old Number	
X-740	X-712	25 parts Sundex-53, 50/50 rosin/fatty acid emulsified
X-743	X-713	25 parts Sundex-53, rosin acid emulsified
X-737	X-716	37.5 parts Sundex-53, 50/50 rosin/fatty acid emulsified
X-724		37.5 parts Sundex-53, rosin acid emulsified

CIRCOSOL-2XH is a relatively naphthenic process aid. Its plasticizing action is not quite as great as that of Sundex-53. However, its nonstaining characteristics permit wider application. With small amounts of peptizers, Circosol-2XH provides desirable processing stocks.

Oil masterbatch polymers containing Circosol-2XH

New Number	Old Number	
X-738	X-628	25 parts Circosol-2XH, 50/50 rosin/fatty acid emulsified
X-745	X-693	25 parts Circosol-2XH, 50/50 rosin/fatty acid emulsified; nonstaining
X-747	X-717	37.5 parts Circosol-2XH, rosin acid emulsified
	X-718	37.5 parts Circosol-2XH, fatty acid emulsified
X-735	X-722	37.5 parts Circosol-2XH, rosin acid emulsified; nonstaining

Oil black masterbatch polymer containing Circosol-2XH

New Number	Old Number	
X-746	X-629	25 parts Circosol-2XH, 50 parts HAF carbon black

For more information about Sundex-53 and Circosol-2XH, write SUN OIL COMPANY, Philadelphia 3, Pa., Dept. RW-4.

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Four new releasing types of Patapar Vegetable Parchment have characteristics which make them ideal as protective backing or wrapping materials for tacky substances. Their dense, fibre-free surfaces release easily from a wide variety of uncured natural or synthetic rubbers. They are used as separator sheets for uncured rubber, rubber tape, and as backing for pressure sensitive surfaces.

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Although each of the four new releasing types of Patapar differ in properties and appearance, each type offers these advantages:

- **Low cost**
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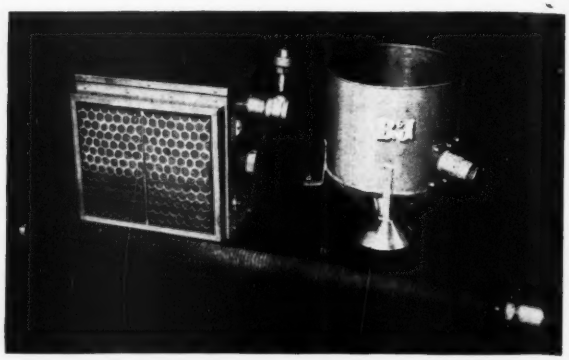


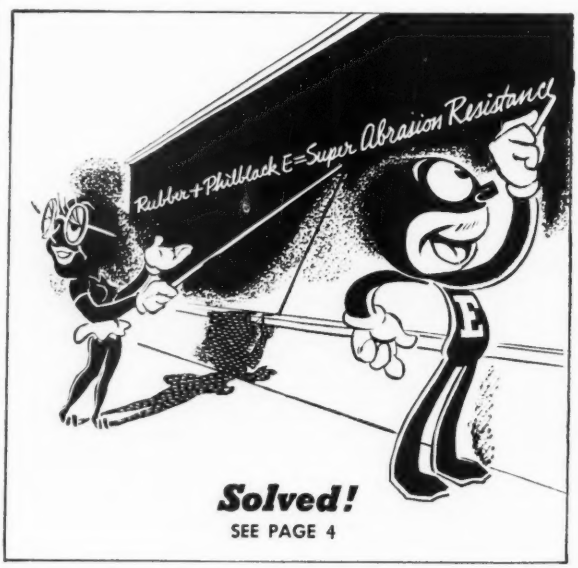
B & J Heater-Dryer for Extruders and Injection Machines Consists of *(Top Left)* Fiberglas Filter, *(Top Right)* Hopper Attachment, and *(Bottom)* Flexible Hose

Molding Machine Heater-Dryer

THE B & J heater-dryer, an attachment for drying or preheating plastic molding material after it has been put into the hopper of any extruder or injection molding machine, has been announced by Ball & Jewell, Inc., Brooklyn, N. Y. Easily installed on top of the injection machine or extruder, the attachment eliminates the extra handling and time required by conventional drying ovens, saves floor space, and permits direct delivery of heated molding material to the machine.

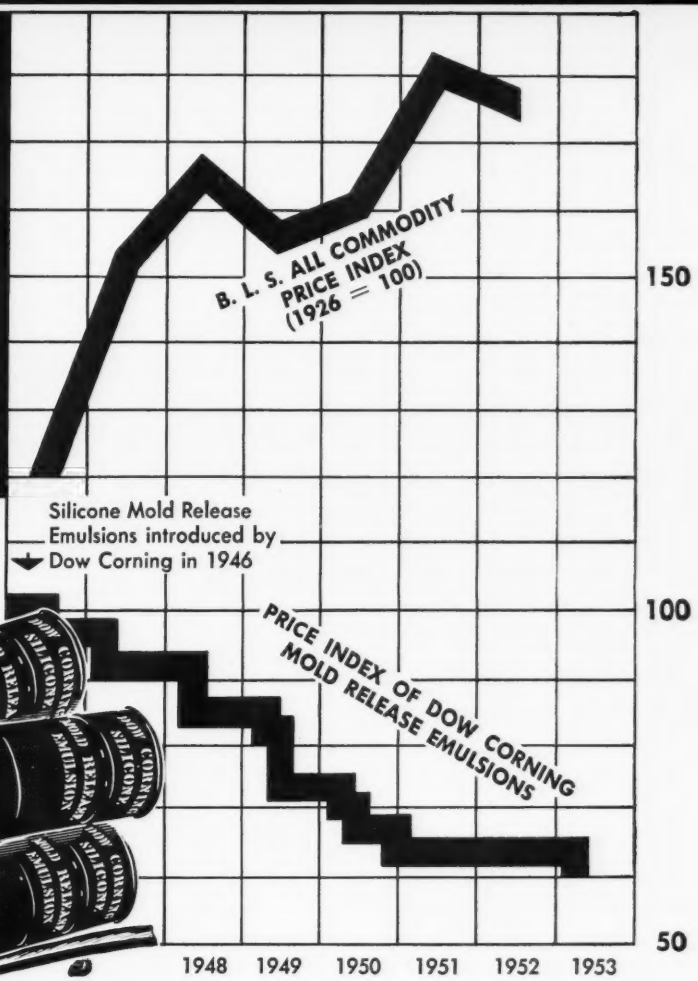
Air is drawn through the large, thick Fiberglas filter which automatically removes dust or dirt. The clean air then passes through the blower and thermostatically controlled heater and through the flexible hose into the hopper attachment to a heat spreader at the bottom of the machine hopper. The heated air, under positive control up to temperatures of 235° F., removes moisture from the molding material. The round design of the hopper attachment eliminates dead spots and permits complete circulation of the heated air. Moisture is dispersed through the opening between the machine hopper and the hopper attachment. Other features of the attachment include positive air volume control; adjustable positioning of the heat spreader to meet the requirements of a specific material; simple installation; and easy cleaning and lubrication.

The heater-dryer is available in three models, with heater capacities of 2,400, 4,800, and 7,200 watts, and blower motor horsepowers of $\frac{1}{8}$, $\frac{3}{4}$, and 1, respectively. The attachment is furnished with a standard replaceable filter and six feet of flexible hose, and with a hopper attachment to fit machine requirements.



SEE PAGE 4

Dow Corning cuts your mold lubricant costs.. again!



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The more Dow Corning Silicone Release Agents you use, the less it costs us to produce these heat-stable mold lubricants. And our savings are passed on to you in the form of lower prices. For example, to meet the steadily growing demand, we have more than tripled our production of silicone release emulsions since 1946. As a result our prices have been steadily reduced until they are now only 60% of the introductory price.

That's pretty conclusive evidence of the important part these materials play in the rubber industry. Seven years of experience in plants all over the world has proven that our silicone mold lubricants reduce scrap to the vanishing point, cut mold maintenance costs as much as 80%; add sales appeal by improving the appearance of finished products.

Tires, mechanical rubber parts, hose and tubing, heels and soles, floor tile, white or heavily loaded stocks unload faster from molds that stay cleaner longer when lubricated with Dow Corning silicone release emulsions. And the cost of the mold lubricant is lower now than ever before!

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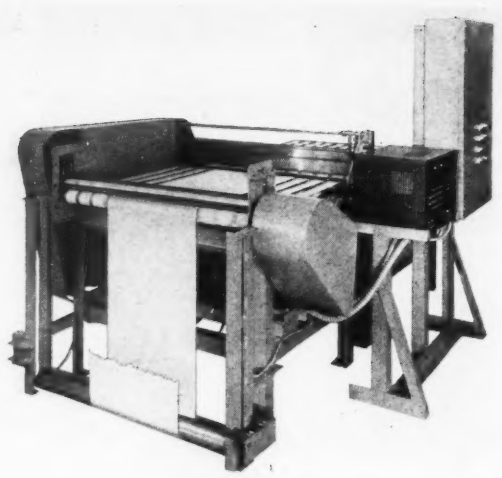


Front View of Improved Jacques Power Shear

New Power Shear

THE Hobbs Mfg. Co., Worcester, Mass., has announced the availability of an improved version of its Jacques power shear which provides versatility in operation and high production at lowered cost. The improvements include exceptionally precise controls and a new slitting attachment.

Material may be fed through the cutting shear in sheet form either manually, semi-automatically by hand, or fully automatically from rolls. Material in web form can also be handled in-process as part of a continuous manufacturing or converting operation. The power shear can be equipped with slitting bars and cutters, enabling material both to be slit into narrow widths and cut to length in one operation.

When the power shear is installed for semi-automatic operation for cutting material from a roll, the material can be fed by the operator bringing feed rolls together; these feed rolls are actuated by chain drive from the main motor. When sufficient material has been fed through the cutter by this method, the cutting knife can be actuated by an electric foot switch. When material is automatically fed in-process for cutting and/or slitting, the material is measured either mechanically or electronically to within a few thousandths of an inch, and the cutting actuated automatically. After being slit and cut, the material can be dropped onto conveyors and carried to the next operation.

"Annual Report, 1952, National Bureau of Standards." Misc. Pub. 207. United States Department of Commerce. For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. 92 pages. Price, 30¢. Summarizing scientific and engineering investigations conducted by NBS during the fiscal year 1952, this booklet contains accounts of current activities as well as more detailed descriptions of representative projects.

STATEX 125

Bags, cures, de-bags in half the time with shafts on TIMKEN® bearings

IN one sequence of operation, this McNeil Twin Bag-O-Matic Tire Press bags, cures and de-bags. It replaces three machines, does the job in half the time!

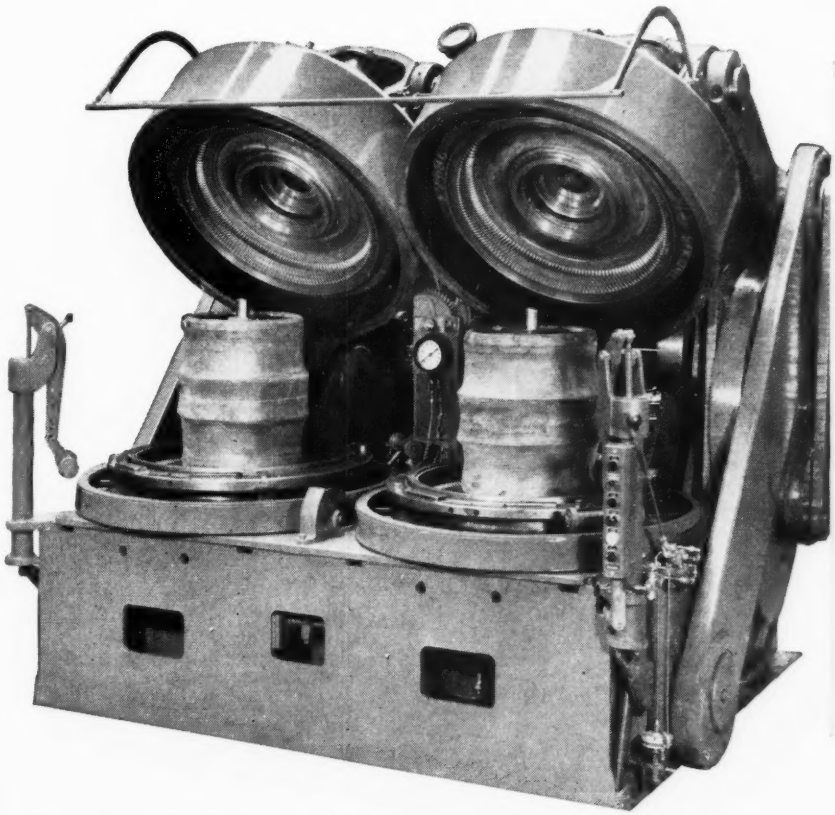
To carry the heavy overhung load of the press connecting link, the eccentric shafts are mounted on Timken® tapered roller bearings. Line contact between rollers and races gives Timken bearings extra load-carrying capacity. Their tapered construction takes radial and thrust loads in *any* combination. Shafts and adjacent parts are held in positive alignment, wear reduced.

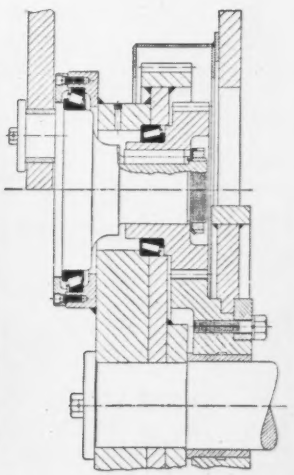
The true rolling motion and incredibly smooth finish of Timken bearings practically eliminate friction. Maintenance and lubrication time and costs are held to a minimum.

Engineered for the job, made of Timken fine alloy steel, precision manufactured, Timken bearings normally last the life of the machine.

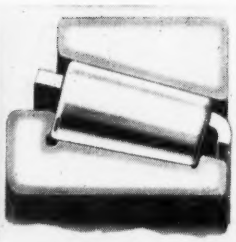
Specify Timken bearings in the machines you build or buy. Look for the trade-mark "Timken" stamped on every bearing. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ont. Cable address: "TIMROSCO".

This symbol on a product means its bearings are the best.





How **McNEIL MACHINE AND ENGINEERING COMPANY** uses Timken bearings to carry the heavy overhung load on the eccentric shafts of its Twin Bag-O-Matic Tire Press.



HARD ON THE OUTSIDE, TOUGH ON THE INSIDE

Rollers and races of Timken bearings are case-carburized to give a hard, wear-resisting surface and a tough, shock-resisting core. Result: longer bearing life.

The Timken Company leads in: 1. advanced design; 2. precision manufacture; 3. rigid quality control; 4. special analysis Timken steels.

TIMKEN

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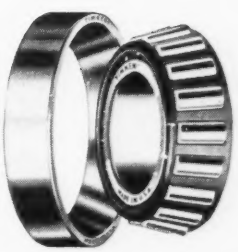
TAPERED ROLLER BEARINGS



NOT JUST A BALL ◯ NOT JUST A ROLLER ▭ THE TIMKEN TAPERED ROLLER ▭ BEARING TAKES RADIAL ◫ AND THRUST ↔ ◫ ↔ LOADS OR ANY COMBINATION ✳

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New Materials

Casein Vehicle for Latex Paints

AQUASPERSE 30, a casein vehicle with reported excellent pigment wetting and dispersing properties for use in the manufacture of latex paints, has been announced by American Resinous Chemical Corp., Peabody, Mass. The vehicle is mixed with the pigment to form a paste which can then be milled and further compounded with the base latex. Aquasperse 30 is a 13% dispersion of casein in water and has a viscosity of 105-110 kinematic units, pH of 8.7-9.2, and weight per gallon of 8.75 pounds. Compounding instructions and suggested formulations are given in the company's Technical Data Sheet C-73

Hot Melt Shoe Adhesive

THE Dewey & Almy Chemical Co., Cambridge, Mass., has developed a new hot melt shoe adhesive, Darex R8. The material is said to be ideal for attaching all types of shanks to wood, fiber, and warm or cold steel with a strong, flexible resin bond. Rapid application is claimed possible owing to the quick cooling and immediate adhesive properties of the material; the resulting bond unaffected by humidity changes has a high impact resistance. Unlike rosin pitches and asphalt, the adhesive does not crystallize or become brittle since it contains no solvent or water to evaporate; consequently the problem of loose shanks is eliminated. The new material is available in one-pound aluminum containers, 45 per carton, and can be applied with a heated grid pan or conventional pitch applicator. It is recommended, however, that a new hot melt spotting machine developed for this purpose be used since application temperatures in the range of 265-280° F. can be more easily controlled with it

German Plastics Industry

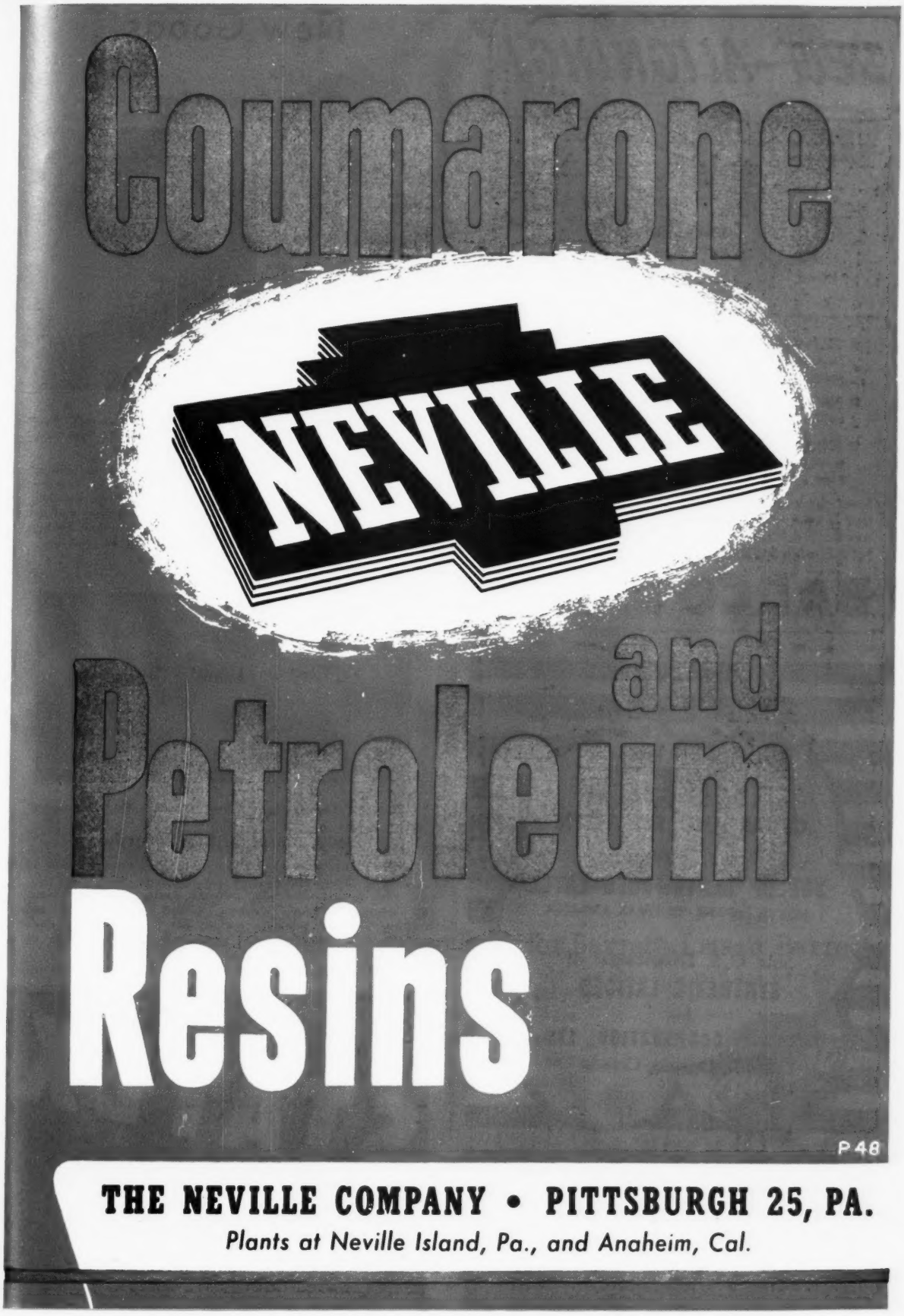
(Continued from page 68)

Netherlands and Sweden, were the best European customers, of the overseas buyers, Brazil and Argentina were the most important.

Exports of goods made from plastics were even more widely distributed, with 60% of the total sold in Europe. The chief consuming countries together took 457.7 tons of these goods, valued at about 4,700,000 marks. Nigeria came first in the value of shipments received from Germany; as regards quantity she was outranked by the Netherlands and Switzerland.

When it is considered that 1952 production figures refer to Western Germany only, it is clear that the present rate of development has caught up with that of the wartime peak, when output had jumped from 68,000 tons in 1938 to more than 200,000 tons in 1943, and it seems certain that actual production for the five-year period 1948-1953 will equal if not exceed that of the 1938-1943 period.

STATEX 125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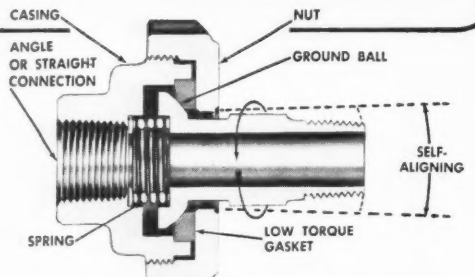

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New Goods

Rubber Feeding Trough

AN ALL-PURPOSE rubber livestock trough that will not tip over, break, rust, or cause injury to livestock has been announced by Goodyear Tire & Rubber Co., Akron 16, O. Made in the company's Los Angeles, Calif., plant, the circular troughs resemble an old-fashioned washtub in construction, but are made of tough fabric and high-quality rubber. Meant to be used as a container for water, salt, feed, or feed supplements, the new trough is practically indestructible, it is further claimed. Crush-proof and unusually resistant to weather, the trough has a smooth surface to prevent its being overturned by animal horns and is sufficiently flexible to remain upright when the sidewall is stepped on by a heavy animal. Ranch or farm trucks can pass over the troughs without damaging them or the vehicle. The rubber compound used in the troughs is odorless and tasteless. The troughs are currently being made in 50- and 100-pound capacities and are easily moved about or stored in stacks.

Goodyear's Rubber Livestock Feeding Trough Resists Damage by Farm Vehicles

Mechanics' Rubbers Made of Neoprene Have No Fabric Lining

Neoprene Industrial Overshoes

INDUSTRIAL overshoes made of du Pont neoprene are being made by Tingley Rubber Corp., Rahway, N. J., for use by men who work around oils, solvents, acids, and other chemicals that damage ordinary rubbers. Called Neoprene Mechanics' Rubbers, the new products are suitable for use in gas stations, garages, creameries, chemical plants, oil refineries, paper mills, and similar industrial locations.

An unusual feature of the overshoes is the omission of the

STATEX 125

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Dispersing Oil 10
CUMAR* Paracoumarone-Indene Resin
BRC* 20 Rubber Compounding Pitch
"BRC" 30 Rubber Compounding Pitch
BRV* Rubber Softener
BRT* 3 Rubber Reclaiming Tar
"BRT" 4 Rubber Reclaiming Tar
Resin "C" Resinous Compounding Material
Dibutyl Phthalate
ELASTEX* 28-P Plasticizer (DOP)
"ELASTEX" 10-P Plasticizer (DIOP)
"ELASTEX" DCHP Plasticizer
"ELASTEX" 50-B* Plasticizer

*Reg. U. S. Pat. Off.

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Long-Lasting Non-Marking

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(at $1.50 each)
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(at $1.37 each)
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fabric lining commonly used in rubbers. Field tests are said to have shown that the omission of the lining has no effect on durability, but does increase lightness and comfort. The rubbers weigh only nine ounces apiece and are sufficiently elastic as to assure a firm grip on the shoe. The ability of the uppers to stretch permits the rubbers to be used on both street and work shoes. The overshoes can be turned inside out for easy cleaning of the smooth inner surfaces. The stretchability of the rubber also permits the stocking of only three sizes to take care of virtually all shoe sizes.

Fishermen's Tackle Belt

A NEW lightweight, waterproof plastic tackle belt for fishermen is being made by Riverside Mfg. Co., Woodstock, Va. Called the Angler's Valet, it consists of a carrier made of Firestone Velon vinyl film, which attaches to a man's belt, and is snugly fitted with nine watertight polystyrene plastic vials and a watertight polyethylene plastic cigarette and match container. Lures of all types, hooks, and sinkers can be carried in the different-size shatterproof containers. The Velon is available in translucent red or blue colors, and the Valet comes in a Velon carrying case with drawstring closure.

Angler's Valet Tackle Belt

The Valet is said to be more practical than lure vests or tackle jackets since it needs no laundering, is waterproof, weighs less than 10 ounces, is compact, and provides immediate availability of all fishing tackle. Rustproof prongs and an elastic web strap permit the Valet to be worn chest high for deep water wading.

Embossed Plastic Billfolds

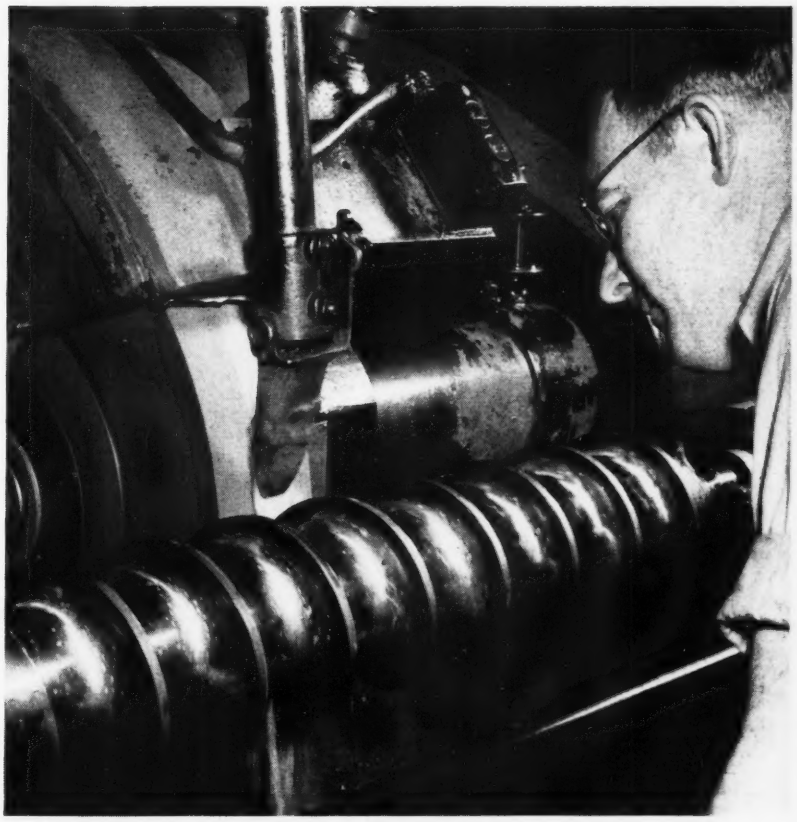
BEAUTIFUL new billfolds styled for women by Lilly Dache are made of vinyl plastic embossed with smart bead and grosgrain textures by Aristocrat Leather Products, Inc., New York, N. Y. Flexible and tear resistant, the Vinylite plastic, a product of Bakelite Co., is easily wiped clean with a damp cloth and resists abrasion, moisture, cosmetics, and most chemicals. The embossed textures, made by the Forrest Process, have the look and feel of grosgrain ribbon basket weave and closely woven bugle-bead designs.

Other features of the billfolds include embossed tabs to con-

(Continued on page 126)

STATEX 125

NRM FEED SCREWS ARE CUSTOM BUILT



The feed screw being finished above is for an NRM rubber Extruder. The only things "standard" about it are the overall dimensions and the skilled craftsmanship entering into its manufacture. At NRM, feed screws — the heart of all extruders—are *custom-built* for perfect integration with the production equipment existing in the customer's plant.

NRM's *creative engineering* has, for 25 years, meant rubber processing machinery of most practical and workable *basic* design. And, as the rubber industry knows, it means that NRM machines have been individually engineered and constructed for the *custom* fitting and adjusting that makes an NRM slip naturally into a particular production setup, and help obtain maximum production "flow" in that plant.

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Rubber and Health

Examples both of the application of rubber in the service of medicine and surgery and of the health hazards connected with the manufacture of rubber goods come in for discussion.[1] Among the rest, benzene poisoning is treated by A. Vallaud.[2] French health authorities had decided that the only sure way of eliminating occupational benzene poisoning was to prohibit any use of benzene in factories. As far as the rubber industries were concerned, however, the order was modified to permit the use of benzene on condition that manufacturers took steps to insure that the concentration of benzene hydrocarbon in the air in work places did not exceed 0.4 gram per cubic meter; where women were employed, this concentration could not exceed 0.2 gram per cubic meter.

There are two methods of determining these concentrations presently under consideration by the Institut National de Securite, with the ultimate view of standardizing and introducing them as official. In the first, total aromatic hydrocarbon is determined by a special sulfonation technique; the second employs the Baernstein process based on the measurement of the purple color yielded by meta-dinitrobenzene with methylethyl ketone. The institute is also promoting the investigation of physical determinations by polarography and ultra-violet absorption.

Both the chemical and the physical processes require the services of experts and well-equipped laboratories. For the physical method, in particular, complicated and expensive apparatus is needed.

Substitutes for benzene have also been studied, and from the health point of view, toluene and cyclohexane have been found satisfactory, but consumer reaction is not very favorable, early returns of an inquiry under way reveal. The rubber industry finds cyclohexane to be an incomplete solvent both for natural and synthetic rubbers; solutions of cyclized rubber are cloudy, settle after a time, and lack adhesive strength. Isopropylbenzene has lately begun to receive attention; it seems to have relatively little toxic effect and will be further investigated.

Some of the uses of silicone elastomers for therapeutic purposes are mentioned in a brief item by H. P. Morel:[3] as tubes for use in blood transfusion, sterilizable heating covers for local thermal treatment, stoppers, caps, elastic membranes, diaphragms and tubing for mechanical hearts, electrode or projector heads for ultrasonic or high-frequency treatment; drains and probes; joints for sterilizers; thin bags for wrapping instruments during sterilization, etc.

The behavior of distilled water in contact with vulcanized rubber pharmaceutical and surgical goods is the subject of a Norwegian article by E. Christiansen,[4] of which the French periodical presents a long abstract. The author studied 27 samples cut from drains, probes, stoppers, etc., heating them in distilled water at 120° C. for 20 minutes. In some cases the resulting decoction was found to be colored; in all cases a rubber-like odor was noticeable whose strength varied with the quality of the rubber, the best

[1] *Rev. gén. caoutchouc*, Dec., 1952.
[2] P. 853.
[3] P. 868.
[4] P. 864.

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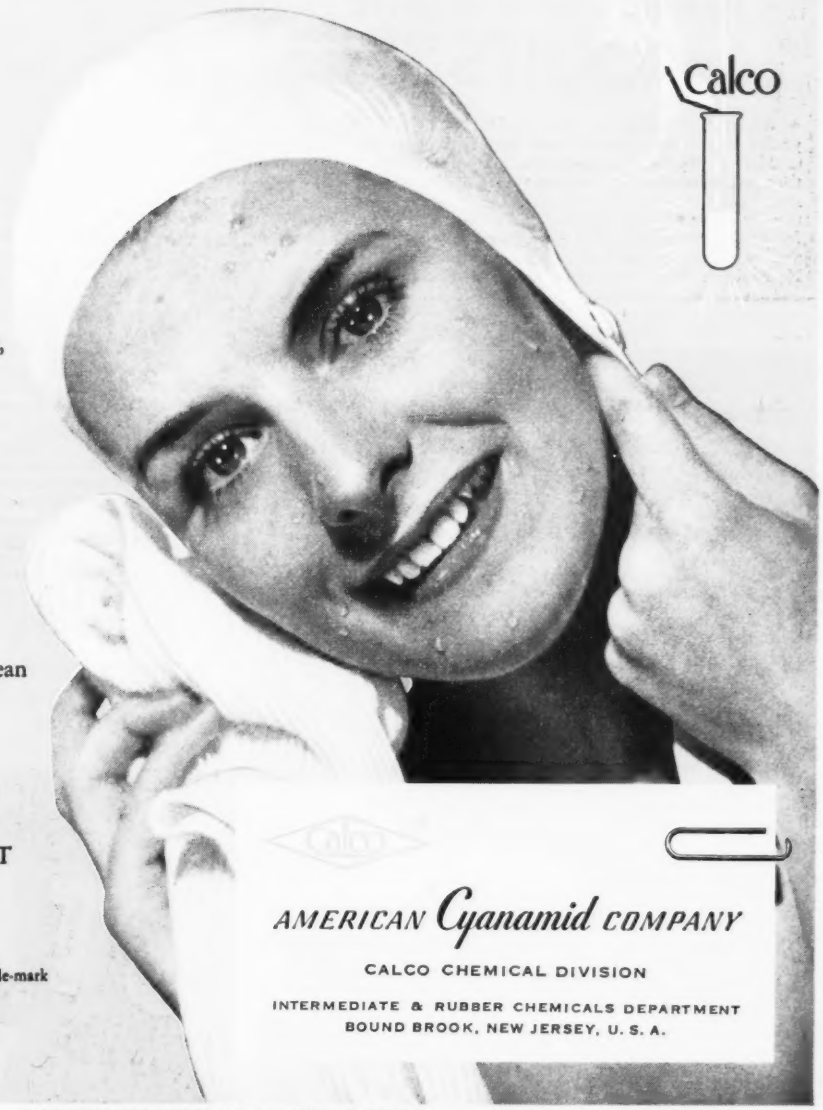

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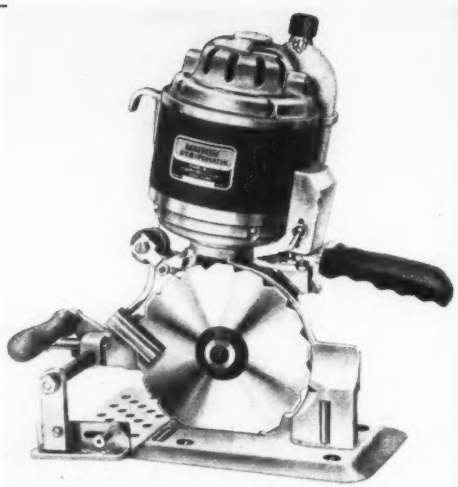
H. M. Royal, Inc., Los Angeles, Calif. • H. M. Royal, Inc., Trenton, N. J. • In Canada: St. Lawrence Chemical Company, Ltd., Montreal and Toronto

MAIMIN STRIPOMATIK



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having the least odor; nitrogen in a form capable of liberating ammonia and the presence of pyrogenous substances were detected; there were variations of pH and of electrical conductivity. A colored reaction with dithizone (diphenylthiocarbazone) was obtained which seems to be related to the pyrogenic effect. A solution of five milligrams of dithizone in 100 cubic centimeters of carbon tetrachloride is used for this reaction; the color of the solution is green, but when a certain amount is mixed with distilled water that has been in contact with vulcanized rubber for a certain number of days, the color turns rose. The number of days of contact required to produce the change in color is very characteristic for each quality of rubber and is called by the author the "dithizone index." On the basis of his findings, he proposes specifications and tests for rubber compounds intended for medical and pharmaceutical goods.

Tire Industry Growing

Thanks to the modernization and expansion of plants undertaken after 1945, the French automobile tire industry now ranks third in the world after the United States and the United Kingdom. There are six large tire concerns employing together about 30,000 persons; in addition there are two companies which make cycle tires only. The following table shows the advances made in the production of tires for automobiles and trucks since 1948:

	1948	1949	1950	1951	First Half, 1952
Passenger car tires . . . . *no.*	2,052,071	3,090,752	3,406,838	4,596,986	2,573,856
Light truck tires	751,256	731,140	756,247	996,264	596,217
Medium truck tires	526,418	546,373	556,631	595,769	305,542
Heavy truck tires	250,850	293,302	305,026	376,625	208,177
Extra-heavy truck tires	82,985	110,761	133,048	184,316	105,137
Total	3,663,580	4,772,328	5,157,790	6,749,960	3,788,929

In the first half of 1952, output of all kinds of tires, including also tires for cycles, motorcycles, tractors, farm machinery, and airplanes totaled 12,320,820 units.

Tackiness of Vulcanized Rubber

Tackiness in vulcanized rubber has not received much attention by investigators although it is frequently met with in certain goods, as insulated cables for instance, L. Toullec points out in his study of this phenomenon.[1] His work aims at determining the influence both of ingredients in compounds and of external factors, and results so far indicate that the type of vulcanizing agent and accelerator used are of prime importance. Curing agents like diazoaminobenzene, benzoyl peroxide, and sulfur (in the absence of accelerators) usually conduce to tackiness; whereas trinitrobenzene and disulfide of tetramethylthiuram do not. Simularly thiocarbanilide and DPG lead to tackiness under all aging conditions, but not MBT, disulfide of benzothiazyl aniline butyraldehyde, or equimolecular combinations of MBT plus DPG.

Mechanical tests indicated that tackiness does not necessarily imply an advanced stage of deterioration due to aging, but is itself a form of aging. Again it could be shown that the presence of pro-oxygen metals is not necessary for the development of tackiness, but it is hastened, and its effect heightened by the presence of Fe, Mn, Cu, or Co. To reproduce the development of tacki-

[1] *Rev. gén. caoutchouc*, 9, 660 (1952).

STATEX
125

THE HISTORY OF THE RUBBER INDUSTRY— No. 2

how long did it take to get from here to here?

Answer: Seven years.

It is reported that natives, in areas where tree rubber was first available, made the first shoes and shoe soles of natural rubber. Rubber-soled shoes are said to have been developed for use in this country around 1898, in Boston, where strips of rubber were nailed onto the shoes of firemen.

By 1905, seven years later, rubber heels and rubber shoe soles were being produced commercially in the United States. Monsanto Chemical Company was founded during this same period, in 1901, and has since become a leader in rubber chemicals research.

Santocure, for example, is an effective mercapto accelerator developed by Monsanto. It gives excellent results in natural, reclaimed and synthetic rubbers. Santocure is also exceptionally safe at processing temperatures but powerful at curing temperatures. For complete information write for booklet "Monsanto Chemicals for the Rubber Industry" or contact MONSANTO CHEMICAL COMPANY, Rubber Chemical Sales, 920 Brown Street, Akron 11, Ohio.

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ALDEHYDE AMINE ACCELERATORS

A-32
A-100

MERCAPTO ACCELERATORS

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El-Sixty*
Ureka* Base
Mertax (Purified Thiotax)
Thiotax (2-Mercapto benzothiazole)
Thiofide* (2,2' dithio-bis benzothiazole)

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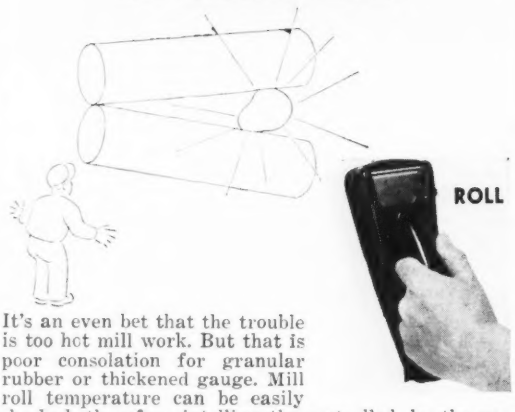
When Lumps show up in the Calender Rolls



It's an even bet that the trouble is too hot mill work. But that is poor consolation for granular rubber or thickened gauge. Mill roll temperature can be easily checked, therefore intelligently controlled, by the use of the Cambridge Surface Pyrometer. It is an accurate, rugged instrument that can be used while the rolls are in operation. Its use will help cut costs and make better rubber products. *Send for Bulletin No. 194-SA.*

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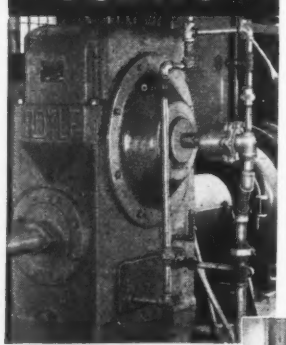
JOHNSON Rotary Pressure JOINTS

Setting a New Pace in the Rubber Industry



When it comes to admitting heating or cooling agents to rotating rolls or drums, the Johnson Joint completely outmodes the old style stuffing boxes. It saves enough in reduced maintenance alone to pay its own way quickly—it is completely packless, self-lubricating, self-adjusting and even self-aligning. In addition, it can materially benefit over-all production—by ending many causes of machinery shut-down, by its more efficient performance, by facilitating better roll drainage.

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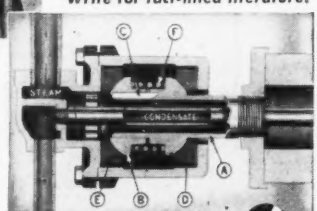


Johnson Joint installed on rubber extruder. Photo courtesy of Manhattan Rubber Div., Raybestos-Manhattan, Inc.

Rotating member consists of Nipple (A) and Collar (B), keyed together (C). Seal ring (D) and bearing ring (E) are of self-lubricating carbon graphite. Spring (F) is for initial seating only; joint is pressure sealed in operation.

The JOHNSON CORPORATION, 869 Wood St., Three Rivers, Mich.

ness, a confined atmosphere is essential: the samples must be kept in a relatively small, unventilated space; hence the Geer oven is not considered suitable for the purpose; instead the use of a small oxygen bomb, at temperatures of 60-70° C. and with pressures of 1-4 kg/cm is suggested.

FAR EAST

MALAYA

To Combat Diseases of Rubber Trees

The dreaded South American leaf disease has fortunately so far not touched the plantations in the Far East. But it is admitted that all *Hevea brasiliensis* trees in this area are probably susceptible to the blight, and investigators are realistically facing the possibility that the thousands of miles of ocean that have hitherto provided a barrier against the disease may, in this age of speedy and frequent air traffic, cease to be effective one day.

The pathological division of the Rubber Research Institute of Malaya describes[1] steps that have been initiated in Malaya to reduce the risk to a minimum and to meet the situation if it should nevertheless occur. Importation of plants by air is prohibited, and importation by other means from Tropical America is strictly controlled. Since it is recognized that the disease could very well spread to Malaya from other parts of East Asia if it once became established anywhere in this region, attempts have been made to get neighboring countries to agree on suitable, uniform legislation, and some progress in this direction has been made.

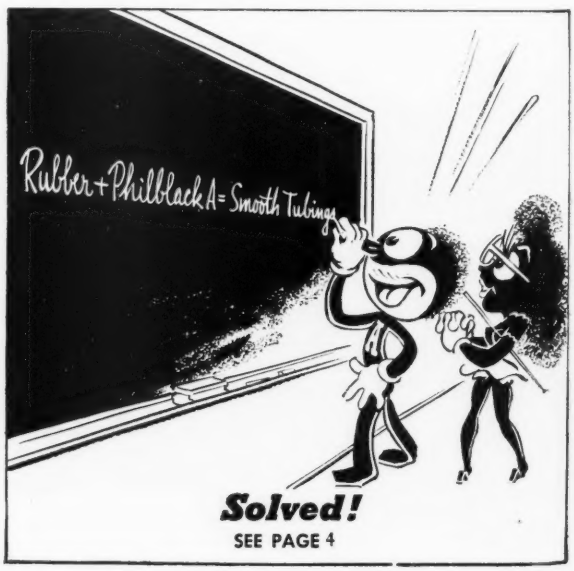
Another line taken is the acquisition of disease-resistant material, and in this both Brazil and the United States have been helpful.

Then the pathological division has undertaken investigations to discover a suitable means of eradicating the blight, should it appear. Results so far indicate that spraying from the air with the normal butyl ester of 2,4,5-trichlorphenoxyacetic acid (2,4,5-T) dissolved in Shell Diesoline might be effective.

Finally, to enable planters to recognize the disease, an illustrated leaflet is to be published.

The pathological division also calls attention[2] to a new malady in young budded rubber. About four feet from the ground, otherwise healthy two-year-old trees suddenly developed a bend in the stem which in the worst cases formed a complete loop. So far it has not been possible to find the reason for this distortion. The unfortunate part of the matter is that in the severer cases, the trees will have to be cut back below the bend, as otherwise, left as they are, they would be untappable when mature.

[1] *Planters' Bulletin*, Nov., 1952, p. 52.
[2] *Ibid.*, p. 62.



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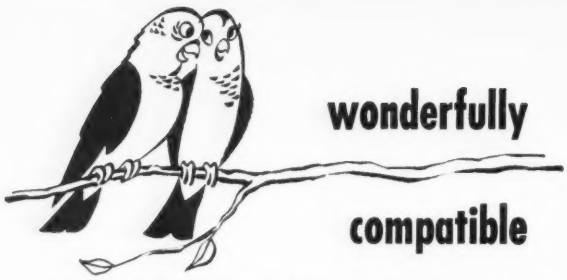

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Rubber Production and Yields

Final production figures for 1952, provided by the International Rubber Study Group, at 584,238 tons show a reduction from the 1951 total of 605,343 tons, as was foreseen earlier in the year. The breakdown into estate and smallholder rubber reveals that the shortfall was due to the lower outputs of the latter, which totaled 245,255 tons in 1952, against 276,553 tons in 1951; estate rubber rose from 328,790 tons in 1951 to 338,983 tons in 1952. According to earlier figures apportionment of 1952 output by nationality gives the share of European estates as 262,158 tons, of Chinese 58,341 tons, Indian 12,113 tons, and other 5,716 tons.

We note that 46% of the European rubber, 36% of Chinese, and 25% of Indian rubber were obtained from high-yielding trees. The overall figure was 148,020 tons out of a total 338,328 tons, or almost 44%. It is worth emphasizing that this amount of rubber was provided by 401,190 acres out of a total tapped acreage averaging 1,575,606 acres over the year—in other words, a little more than 25% of total acreage yielded almost 44% of total output.

From details of yields per tapped acre per annum in 1952, it is seen that both in the case of rubber from ordinary trees and of rubber from high-grade trees, yields were highest on European-owned estates, 380 and 847 pounds per acre, respectively. The trend of output on all estates during 1950, 1951, 1952, may be summarized as follows:

	1950	1951	1952
Yields, in pounds per acre per annum			
From ordinary trees	429	355	363
High-yielding trees	818	797	826
Total trees	511	460	481

Special details regarding smallholder rubber are not available. The decline in output in 1952 is ascribed to a combination of overtapping, results of terrorism, and lower prices and probably will not be corrected in the current year since the replanting scheme has gotten under way and thousands of old trees are being cut down.

Revised figures for latex put total production in 1952 at 47,625 long tons (dry rubber cement), which included 34,065 tons of 59-62% centrifuged concentrate, 6,483 tons, 62% cream concentrate, and 3,827 tons prepared by other methods including Revertex.

In addition, were produced 7,187 tons of special rubber, of which 610 tons were softened rubber including peptizers; the rest consisted of rubber specially prepared by other patented or technically specified procedure (excluding chemically modified rubber, of which there seems to have been none).

Wage Disputes

Proposals on wage rates are once again causing friction between the Malayan Planting Industries Employers' Association (MPIEA) and the Pan Malayan Rubber Workers' Union. The point at issue this time is the wage scale judged applicable by the Whitton Arbitration Board when rubber prices are between 60 and 70 cents (S.S. currency) per pound. The MPIEA refuses to commit itself to the award on the grounds that future production costs are unforeseeable. It added, however, that this refusal did not exclude the possibility that the wages under the award might be paid if they were justified by circumstances.

The Union took the stand that since the MPIEA had accepted the Whitton award for wages when prices were between 70 and 80 cents, and 80 and 90 cents, there was no valid reason why it should exclude the third price zone, between 60 and 70 cents, from the wage agreement. Workers would have no peace of mind, it was explained, until they were assured of Whitton award wages for all three price zones between 60 and 90 cents per pound, and the Union insisted that the agreement cover all the price zones, or none at all.

This new wage difference seems to be more sharply pointed up by the criticism of the basis of the Malayan rubber industry's wage structure made by T. S. Bavin, secretary of the plantations department of the International Confederation of Free Trade Unions. Mr. Bavin, who recently arrived to head a mission studying plantations in Malaya, found that the basic clause which ties the wages of rubber workers to ruling rubber prices, was "loaded with danger." It always held over the rubber worker the threat of poverty and hunger if the rubber price fell to a low level. He condemned the tendency in Malaya and other Asian countries to overlook the human factors in wage negotiations and added that other means than wage cuts should be sought to improve an unsatisfactory economic situation in an industry.

CEYLON

The Rubber Commissioner has appointed three boards of rubber inspectors who will examine the sheet rubber that is to go to Red China under the long-term trade agreement and will issue quality and weight certificates for each consignment. The China National Import & Export Corp. has agreed to accept these certificates as valid, for the present anyway.

Communist China seems to be in a rush to get rubber as fast as possible, and cargo vessels chartered by her are arriving faster than the material can be collected, it is reported from Colombo. Shipments totaling about 8,000 tons were scheduled for February.

European shippers who normally handle about 70% of Ceylon's sheet exports have been protesting government policy aiming at eventual exclusion of all but Ceylonese shippers in the China rubber deal. It has been buying from the former such quantities of sheet as the Ceylonese have not been able to supply, but is transferring the trade to the latter as fast as their capacity to handle orders increases, until the whole business will be in the hands of Ceylonese.

According to a local press report, certain European rubber shippers are considering, as a means of getting over the difficulty, admitting Ceylonese on their directorates.

A high government official is quoted as saying: "Most of them (non-Ceylonese concerns) will sooner or later realize that they cannot have any sort of government protection or guarantee if they didn't have a large measure of Ceylonese capital in their businesses."

Meanwhile crepe rubber, which China apparently persists in refusing to buy, continues to be a headache. The remedy reportedly proposed is for government to establish, with part of the profits on the rice-rubber deal, a buffer fund for stabilizing crepe rubber prices.

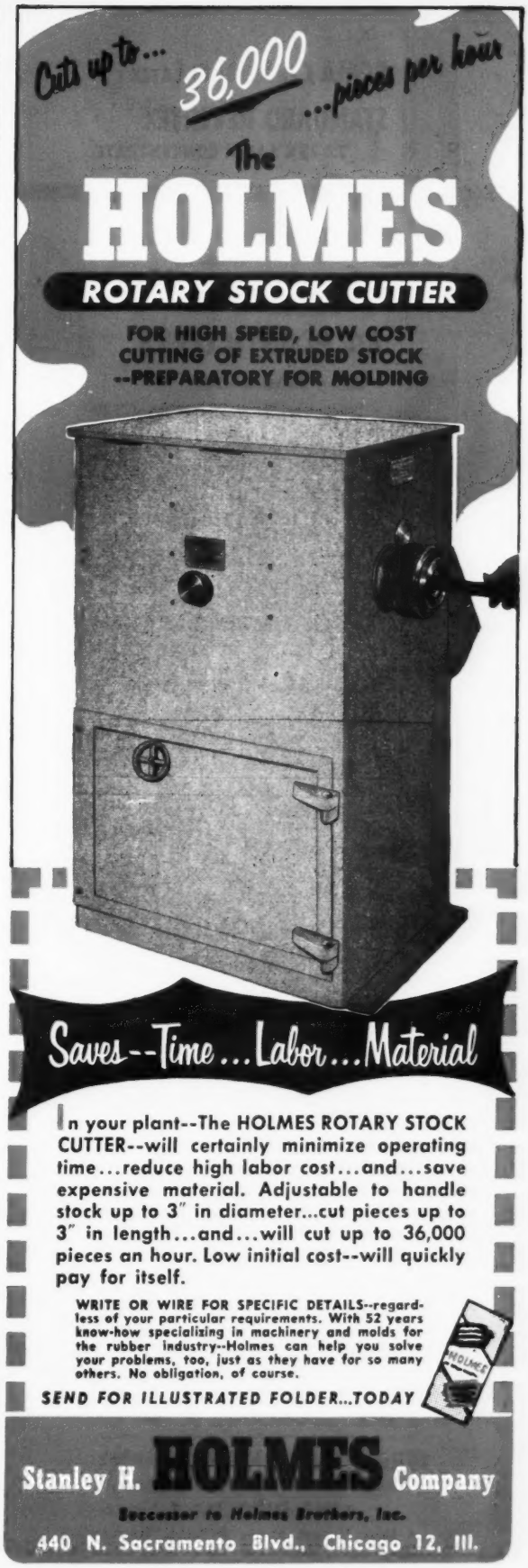
Another problem for the Ceylon Government is financing the rubber-rice deal. Cash is needed to pay for 80,000 tons of rice bought from China under short-term agreement, and cash is also required to buy rubber from producers to fulfill commitments under the long-term trade agreement with China, and the government is planning to borrow 100,000,000 rupees by issue of treasury bills. It should be added, that the Finance Minister stated that Ceylon is comparatively well off, and that its financial position is sounder than that of many counries in southeast Asia.

Ceylon's production of rubber during 1952 came to about 96,500 long tons, against 105,000 tons in 1951, data released by the Secretariat of the International Rubber Study Group indicate. The decrease here, as in Malaya and Indonesia, was mainly caused by sharp reduction in output on smallholdings.

Figures for estate rubber give a total of 80,000 tons for 1952, made up of 42,655 tons of sheet, 17,677 tons of latex crepe, 5,412 tons of sole crepe, 12,928 tons scrap crepe, and 1,328 tons of latex.

PAKISTAN

The Pakistan Government is understood to be considering steps to develop the local industry and to improve the quality of the products made. To this end, it is said to be planning to obtain the services of technical experts from abroad.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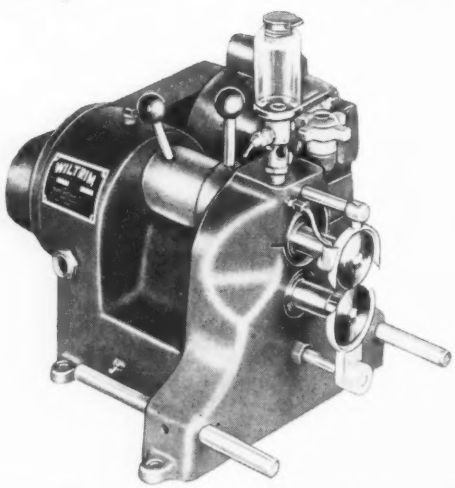

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Editor's Book Table

BOOK REVIEWS

"Chemicals of Commerce." Second Edition. Foster Dee and Cornelia T. Snell. D. Van Nostrand Co., Inc., 250 Fourth Ave., New York, N. Y. Cloth, 5½ by 8½ inches, 596 pages. Price, $6.50

This revised and up-to-date edition gives in concise form the salient facts about chemicals and chemical materials sold in important commercial quantities. Written in essentially non-technical language and intended for the practical man, the book emphasizes information on the compositions of actual commercial products as sold, rather than as the pure chemicals described in textbooks. Classification is by type of compound, and each chapter begins with a discussion of the general background and chemical nature of the class of materials described therein. There are 37 such chapters dealing with material classes, as well as an introductory chapter and several appendices giving related information.

"Writing the Technical Report." Third Edition. J. Raleigh Nelson. McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36, N. Y. Cloth, 6 by 9 inches, 369 pages. Price, $4.50.

In contrast with most books on technical writing which stress form and convention, this volume places major emphasis on basic principles and procedures, with the aim of developing proper attitudes and sound judgment. Since a report is planned for a specific use or purpose, it is the author's intention to aid the writer in grasping and evaluating the salient features of the problem which is the subject of the report. As such, the book will be of interest and value to students and professional men faced with the need of writing reports and similar communications.

The book is divided into five sections. The first deals with the design and composition of the report. The second section gives specific directions for setting up reports, illustrated with annotated samples. A systematic procedure for the critical examination of the report appears in the following section, together with clinical studies of typical cases. A summary of the fundamentals treated is presented in the fourth section, and the concluding section consists of a manual for a course in report writing that can be used either as a course of study for classroom or individual purposes. An adequate subject index is appended.

"Directory of the International Rubber Industry." Publishers, Verlag für Wissenschaftsliteratur, G.m.b.H., Zurich, Switzerland. Cloth, about 6½ by 9 inches, 416 pages. Price $12. [U. S. representative, Swiss American Advertising Co., 1910 Marmion Ave., New York 60, N. Y.]

The object of this directory, the publisher states in a foreword, is to provide a complete review of the rubber industry throughout the world for those interested, buyers as well as producers. The publisher has accordingly supplied available names of rubber goods manufacturers in Europe, North, Central, and South America, Africa, Asia, Australia, and New Zealand, arranging the names in the alphabetical order of the countries in each continent and according to the alphabetical order of the cities in which firms are located. In view of the limits imposed by the very extent of the undertaking, only manufacturers of rubber goods and manufacturers of synthetic rubber have been

STATEX 125

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listed. On the other hand, addresses of rubber educational and research institutes, trade associations and trade papers are given, and there are a list of suppliers to the trade and an advertisers' index.

Details regarding the main products of the companies, their branches, brand names, and frequently the number of employes are given along with the addresses, in the national language if this is English, French, or German. Otherwise German and English or English and French are used. However, the information is made accessible to anyone knowing at least one of these languages by the provision of three-language vocabularies.

We note with interest the complete absence of Soviet Russia among the countries included; the satellites, Hungary, Rumania, and Czechoslovakia, are represented only by their respective sole, national importing and exporting organizations. The Polish list, however, includes most of the well-known prewar names: Pe-pe-ge, Gentlemen, Wolbrom, Stomil; about two dozen names are found under eastern Germany, or German Democratic Republic, as it is here called.

Even a cursory glance through the directory reveals interesting facts. Finland is there with three factories making tires, the largest employing 3,000 persons. Rubber footwear is an important item here, and one footwear concern employs just over 600 persons. Footwear, heels, and soles are also prominent in Turkey, which appears with several factories having 150 workers and over—two have more than 1,000 employes. Names of rubber manufacturers in Japan and India cover eight and ten pages, respectively; Java is a surprise with about 50 names; several firms employing 200 persons and more, mostly specializing in mechanical goods and footwear.

Even the little island of Madeira, off the North West Coast of Africa, appears with one factory making tubes and hose, tiles, mats, and flooring.

NEW PUBLICATIONS

Publications of Emery Industries, Inc., Carew Tower, Cincinnati 2, O.

"Emery 901-R Azelic Acid." No. 40. 2 pages. Tentative specifications, characteristics, composition data, and typical reaction of this product appear in this bulletin.

"Rapid Composition Analysis of Commercial Stearic Acids." No. 43. 12 pages. Test procedure and necessary data for determining the composition of commercial stearic and palmitic acids by a simplified procedure based on titer and iodine value tests only, are given in this publication.

"Plastics Packager." No. 1, 1953. Monsanto Chemical Co., Springfield, Mass. This four-page, illustrated leaflet is the first issue of a new company publication devoted primarily to applications of plastics for packaging materials.

Publications of the Goodyear Tire & Rubber Co., Akron, O. **"Pliovic G90V."** Techni-Guide PVR-100-6. 7 pages. **"Pliovic G80V."** Techni-Guide PVR-100-7. 7 pages. These manuals describe the physical properties, compounding, processing, forming, and formulations of the two polyvinyl chloride resins, both of which are claimed to exhibit exceptional stability to the deteriorating effects of heat and light.

STATEX
125

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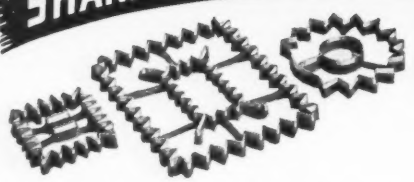

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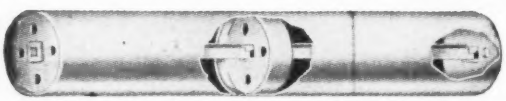

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"Indonex Plasticizers in High Mooney Neoprene (Type WHV)." Circular 13-47. Indoil Chemical Co., Chicago 80, Ill. 6 pages. Data on the properties of test compounds formulated using three grades of Indoil plasticizers are given and discussed in this catalog insert.

"Chronological List of Technical Papers Relating to the Government Synthetic Program." Compilation DRP-4-S1. Office of Synthetic Rubber, Reconstruction Finance Corp., 811 Vermont Ave., N. W., Washington 25, D. C. 10 pages. This compilation is a supplement to the list, DRP-4, October 10, 1952, in which published papers dealing with the work supported by the RFC are chronologically given. The listing, by company or organization, is shown by title, author, publication, and date of publication. A separate five-page author index for this compilation is also available.

Publications of Dow Corning Corp., Midland, Mich.

"Dow Corning Silastic R Tape." Silicone Notes No. 10-500. 4 pages. This publication describes the properties and applications of this insulating tape.

"Dow Corning Silicone Varnish 997." Silicone Notes No. 10-220. 22 pages. The properties and applications of this silicone varnish are given in this catalog insert.

"Neoprene Notebook." No. 53. E. I. du Pont de Nemours & Co., Wilmington, Del. 8 pages. This issue of the Notebook features an article describing a new gasket material made of asbestos bonded with neoprene. Other stories describe the use of neoprene in conveyor belts, shock-absorbing clutches, inflatable panels, and diaphragms used in the fluid forming of metals.

"Research for Industry: Molded Products and Coatings". Franklin Institute Laboratories for Research & Development, Philadelphia 3, Pa. 16 pages. This booklet describes the activities of the Institute on the subject of molded products and coatings in the fields of rheology, reaction kinetics, stress analyses, diffusions and permeabilities, wetting and adhesion, polymer studies, and special properties.

"Studies of Accidents in the Rubber Industry." National Joint Industrial Council for the Rubber Manufacturing Industry, Royal Exchange, Cross St., Manchester 2, England. 99 pages. Practical measures for accident prevention work in factories are given on the basis of an analysis of British rubber industry accidents covering a period of 30 months.

"Silicone Rubber O-Rings." Technical Data Sheet No. 103. Beacon Industries, Inc., 192 Pleasant St., Watertown, Mass. 1 page. A compilation of dimensions of regular and special sizes of silicone rubber O-rings, including their physical property specifications, is herein presented.

"Tlargi Yearbook, 1953." Volume XII. The Los Angeles Rubber Group, Inc., Statler Hotel, Los Angeles 17, Calif. 84 pages. This attractive, illustrated yearbook commemorates the Group's twenty-sixth anniversary. The book's contents include officers, directors, and committees of the Group; a description of the Tlargi Rubber Technology Foundation; activities and meetings held during 1952; membership list; suppliers to the rubber industry; a list of Pacific Coast rubber manufacturers and principal products; and a number of technical features including articles on GR-S polymers.

"Uses of Persulfates." Bulletin No. 34. Buffalo Electro-Chemical Co., Inc., Buffalo, N. Y. 20 pages. This bulletin presents a bibliography of approximately 100 references concerning the properties and uses of persulfates over the period of 1907-1950.

"Ace Tempron: Heat-Resistant Synthetic Hard Rubber." No. 96-B. American Hard Rubber Co., New York, N. Y. 3 pages. The physical, electrical, and chemical properties of this nitrile rubber are described in this publication.

"High Surface Sodium on Inert Solids." U. S. Industrial Chemicals Co., 120 Broadway, New York 5, N. Y. 16 pages. This booklet is a working manual and guide to procedure for intended users of metallic sodium dispersed in colloidal dimensions over inert solids of high surface area.

Publications of the British Rubber Producers' Research Association, 48 Tewin Rd., Welwyn Garden City, Herts, England.

No. 163. **"Apparatus for the Measurement of the Dynamic Shear Modulus and Hysteresis of Rubber at Low Frequencies."** W. P. Fletcher and A. N. Gent. 3 pages. Apparatus is described, and typical results are given for applying a simple shearing force to rubber in order to calculate dynamic shear modulus and hysteresis.

No. 164. **"Experiments on the Mechanics of Rubber.** Part I. Eversion of a Tube. Part II. Torsion, Inflation, and Extension of a Tube. Part III. Small Torsions of Stretched Prisms." A. N. Gent and R. S. Rivlin. 24 pages. Part I measures the dimensional changes occurring when rubber tubes are turned inside out and compares these values with those predicted from theory. In Part II, experiments on extension, inflation, and torsion of a tube indicate that hysteresis between loading and unloading curves for the vulcanizate is associated with its stored energy function. Part III records data verifying a theorem which relates torsional modulus for small torsions to extension ratio and force for rods of vulcanized rubber of rectangular cross-section.

No. 165. **"Mastication of Rubber.** Part I. Mechanism of Plasticizing by Cold Mastication." M. Pike and W. F. Watson. 24 pages. A mechanism is proposed for the degradation of natural rubber by the cold mastication process, with a similar method applicable to synthetic rubbers.

No. 166. **"The Load Dependence of Rubber Friction."** A. Schallamach. 5 pages. It is shown experimentally that the load dependence of rubber friction can be explained as being due to the load dependence of the true area of contact between rubber and track if the rubber surface asperities are assumed to be hemispherical.

No. 167. **"The Addition of Thio-Compounds to Olefins.** Part III. Reaction of Tri- and Hexa-Methylenedithiols, and of Bisthiol-Adipic and -Sebacic Acids." J. I. Cunneen. 5 pages. Certain dithiols and bisthiol-acids react with natural rubber and some related simple olefins in an analogous manner to the corresponding monofunctional compounds. The physical properties of vulcanizates obtained from natural rubber and bisthioladipic acid are described.

No. 169. **"Abrasion Pattern on Rubber."** A Schallamach. 13 pages. Various properties of the abrasion pattern of rubber are described and compared with that formed on a tire.

No. 170. **"2-Mercaptobenzothiazole Derivatives.** Part I. The Reaction of Di(Benzothiazol-2-Yl) Disulfide with Olefins." C. G. Moore. "Part II. The Thermal Decomposition and Isomerization of 2-Alkyl- and 2-Alkenyl-Thiobenzothiazoles and 3-Alkyl- and 3-Alkenyl-2-Thiobenzothiazolines." C. G. Moore and E. S. Wright. 21 pages. A brief kinetic study described in Part I indicates that the reaction is a free-radical chain mechanism. In Part II, mechanisms of the decomposition and isomerization reactions are discussed, and the reversible isomerization related to the Claisen and analogous rearrangements is detailed.

No. 171. **"The Thermal Decomposition of Cyclohexenyl Hydroperoxide in Hydrocarbon Solvents."** L. Bateman and H. Hughes. 8 pages. Kinetic and product data on the reaction are reported and compared with results of other similar investigations.

"Butvar and Formavar: Polyvinyl Butyral and Polyvinyl Formal Resins for Surface Coatings." Production Information Bulletin No. 72. Monsanto Chemical Co., Springfield, Mass. 10 pages. The properties of these resins and suggested formulations for possible applications of these materials in the surface coatings field are described in this booklet.

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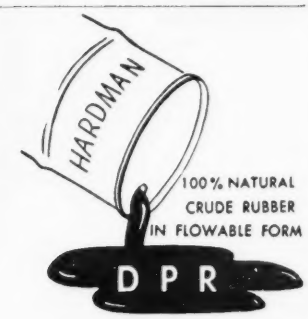

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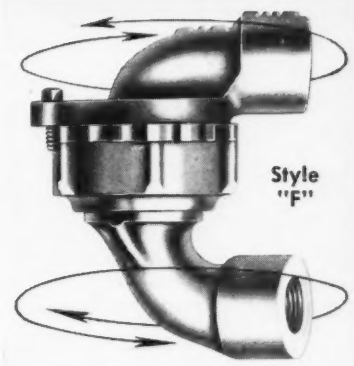

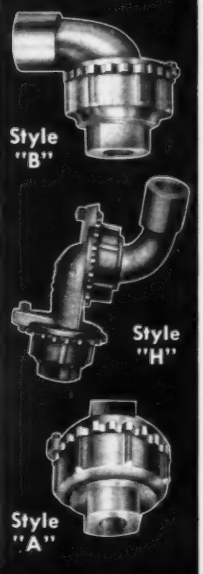

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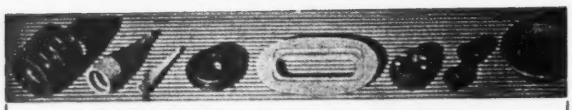

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Embossed Plastic Billfolds

(Continued from page 108)

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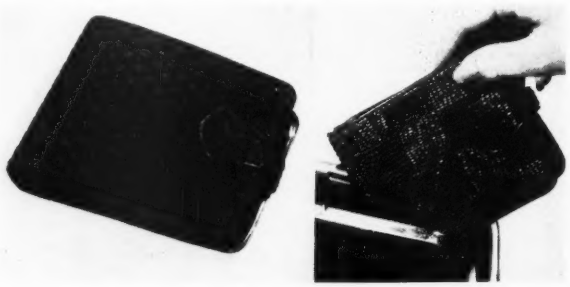

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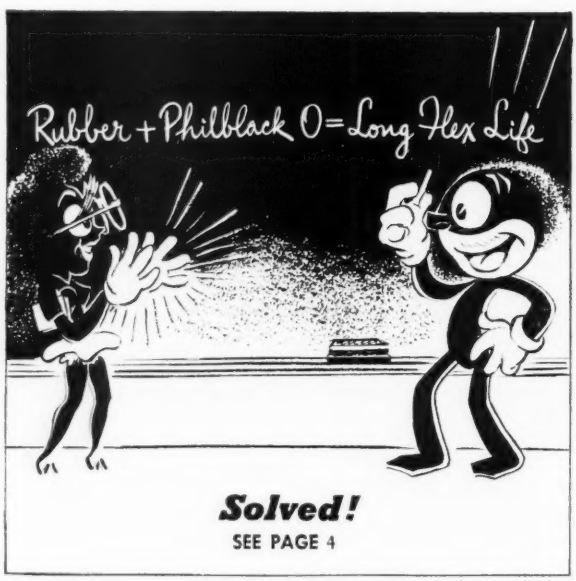

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Chemical background preferred. Should have knowledge of natural and synthetic compounds and market in the Great Lakes region. A real opportunity for the right man. A chance to build and develop a new division for a well-established concern. Moving and other expenses will be considered. Write giving essential information. Address Box No. 1288, care of INDIA RUBBER WORLD.

RUBBER PRESS & EXTRUSION SUPERINTENDENT

Experienced in all phases of operation. Must have working knowledge and be capable of setting up and operating latest-type production equipment for many of automotive and aircraft mechanical goods. Salary commensurate with ability. Moving expenses will be considered. This is a well-established South Michigan corporation. Write giving essential information. Address Box No. 1289, care of INDIA RUBBER WORLD.

SITUATIONS WANTED

RUBBER CHEMIST, SPONGE RUBBER AND MECHANICAL RUBber development and production. Address Box No. 1280, care of INDIA RUBBER WORLD.

FOREMAN, PROCESSING, PRODUCTION MANAGER. TIRES, heels, soles, canvas footwear, sponge. Mixing, calendering, tubing, SS Neoprene, GR-S. Wants change, West Coast preferred. Have handled union labor successfully. Employed Midwest. Address Box No. 1281, care of INDIA RUBBER WORLD.

PRODUCTION MANAGER DESIRES NEW CONNECTIONS. Exceptionally qualified by having had 20 years of broad practical and technical experience manufacturing all kinds of mechanical and sponge rubber products. Familiar with all phases of manufacture. Address Box No. 1290, care of INDIA RUBBER WORLD.

EXECUTIVE RUBBER ENGINEER WANTS TO RELOCATE. TEN years of top-level experience in plant management, research and development compounding, engineering design, production, costing and sales of aircraft, automotive, and other-type mechanical molded rubber products. Address Box No. 1291, care of INDIA RUBBER WORLD.

MACHINERY AND SUPPLIES FOR SALE

FOR SALE: 1—BALL & JEWELL NO. 1½ ROTARY CUTTER. Stainless Steel. 4—Mikro pulverizers #1-SH, #1-SI, #2-SI, #2-TH. 2—Kux rotary pellet presses. 4—Stokes D-3 rotary pellet presses. Read 600-lb. jacketed ribbon mixer. Large stock stainless steel tanks and kettles. PERRY EQUIPMENT CORP., 1424 N. 6th St., Philadelphia 22, Pa.

FOR SALE: FARREL 16" X 48" AND 15" X 36", 2-ROLL RUBBER mills and other sizes up to 84". Also new lab. 6" x 12" & 6" x 16" Mixing Mills and Calenders. Extruders, 1" to 3". Baker-Perkins Mixers 100, 50, & 9 gals., heavy-duty, double-arm. Bail & Jewell & Leominster Rotary Cutters. HPM 200-ton Vert. Hydr. Press, 4-opening upstroke, 32" x 50" platens. Large stock of Hydraulic Presses from 12" x 12" to 48" x 48" platens from 50 to 2,000 tons. Hydraulic Pumps and Accumulators. Crushers, Churns, Rubber Bale Cutters, etc. SEND FOR SPECIAL BULLETIN. WE BUY YOUR SURPLUS MACHINERY. STEIN EQUIPMENT CO., 107 — 8th St., Brooklyn 15, N. Y. Sterling 8-1944.

HYDRAULIC PUMPS

2—Single acting plunger type vertical tri-plex power pumps, size 1¾" x 6", 42.6 GPM, discharge pressure PSIA 2900#, motor driven, new 1944, price on request.

DALTON SUPPLY CO.

2829 Cedar Street **Philadelphia 34, Pa.**

(Classified Advertisements Continued on Page 129)

MARKET REVIEWS

RUBBER

LIGHT, scattered trading and a downward price movement featured the physical rubber market during the period from February 16 to March 15. Despite the lack of factory buying interest, prices rose during the second half of February following the lead of the foreign markets. A general price decline set in during the first half of March as domestic purchasers moved out of the market as the result of high priced offerings. As usual, most of the actual purchases made on the spot market were for the lower grades, and the greater part of the demand was said to come from the wire and cable industry.

NEW YORK SPOT MARKET
WEEK-END CLOSING PRICES

	Dec. 27	Jan. 31	Feb. 21	Feb. 28	Mar. 7	Mar. 14
R.S.S. #1	32.00	28.50	28.00	28.00	27.75	26.50
2	31.00	27.63	27.25	27.25	27.00	25.75
3	30.00	26.88	26.00	26.00	25.75	24.50
Latex Crepe:						
#1	39.75	35.38	32.75	32.25	31.75	31.00
Thin	39.75	35.38	32.75	32.50	31.75	31.00
#3 Amber						
Blankets	29.25	25.63	25.25	25.25	24.75	24.25
Thin Brown Crepe	28.25	24.63	24.25	24.25	23.75	23.25
Flat Bark	26.75	23.63	22.50	22.25	22.00	21.50

The spot price for #1 Ribbed Smoked Sheets started the period at 27.75¢, rose to a high of 28.25¢ on February 26 and again on March 4, and then declined to a low of 26.50¢ on March 12 and 13. The February monthly average spot prices for certain grades were as follows: #1 R.S.S., 27.96¢; #3 R.S.S., 25.99¢; #3 Amber Blankets, 25.06¢; and Flat Bark, 22.63¢.

COMMODITY EXCHANGE
WEEK-END CLOSING PRICES

Futures	Dec. 27	Jan. 31	Feb. 21	Feb. 28	Mar. 7	Mar. 14
May	29.80	27.40	26.95	26.90	26.65	26.20
July	29.30	27.00	26.55	26.50	26.05	25.65
Oct.	28.90	26.55	26.25	26.25	25.70	25.25
Dec.	28.40	26.20	26.05	26.00	25.51	25.00
Mar.	28.40	26.20	26.05	25.85	25.35	24.85
Total weekly sales, tons	740	3,350	1,250	2,190	3,200	3,730

Rubber futures price movements on the New York Commodity Exchange followed the lead of the physical market and showed a general decline over the period. Market activity was on the slow side, and most of the trading was professional in nature, consisting of short coverings on price rises and liquidations on the downtrends. Sales during the second half of February amounted to 3,440 tons in the #1 Contract, and 60 tons in the #3 Contract. Monthly sales totals for February in the two contracts were 6,830 and 70 tons, respectively. Somewhat greater activity was noted during the first half of March, aided in part by liquidations and transfers of the March interest, to give total sales of 6,930 tons in the #1 Contract and 170 tons in the #3 Contract.

As for actual price movements, May futures started the period at 26.65¢, rose to a high of 27.50¢ on February 26 and again on March 4, dropped to a low of 26.10¢ on March 12, and recovered slightly to end the period at 26.20¢. Other futures prices showed corresponding movements during the period under review.

Latex

NO IMPORTANT changes took place in the *Hevea* latex market during the period from February 16 to March 15. Both demand and the tight supply situation continued unchanged. Bulk prices for March-April deliveries remained at 39-40¢ per pound solids, and May-June deliveries were quoted at 38¢ per pound solids. Indications are that the shortage in *Hevea* latex will continue throughout the year. The current wintering season is expected to prevent any increase in supplies until after June, but further increases in demand are predicted that will more than offset the available supply.

Final December and yearly totals, 1952, and preliminary January, 1953, domestic statistics on *Hevea* and synthetic rubber latices are given in the following table:

(All Figures in Long Tons, Dry Weight)

	Production	Imports	Consumption	Stocks
Natural latex:				
Dec.	0	6,033	5,493	6,201
Year, 1952	0	48,228	53,467	6,201
Jan.*	0	5,000	6,046	6,139
GR-S latices:				
Dec.	4,325	237	3,863	5,040
Year, 1952	39,543	2,730	40,562	5,040
Jan.*	4,063	262	4,269	5,072
Neoprene latex:				
Dec.	778	0	704	1,019
Year, 1952	7,598	0	7,368	1,019
Jan.*	895	0	764	1,177
Nitrile latices:				
Dec.	452	0	336	902
Year, 1952	4,164	0	3,093	902
Jan.*	451	0	347	959

*Preliminary.

RECLAIMED RUBBER

THE reclaimed rubber market showed no new developments during the period from February 16 to March 15. Production and demand continued at good levels, with the greatest consumption of reclaim being in the automotive industry. While consumption of reclaim by other industries showed some slackening, this drop was counterbalanced by an improvement in demand by tire and tube, battery, and automotive rubber goods manufacturers. There were no changes in reclaim prices during the period.

Final December and yearly totals, 1952, and preliminary January, 1953, statistics on the domestic reclaimed rubber industry are now available. December figures, in long tons, are: production, 25,606; imports, 36; consumption, 24,300; exports, 1,012; and month-end stocks, 30,664. Yearly totals for 1952, in long tons, follow: production, 278,386; imports, 1,595; consumption, 280,002; exports, 11,180; and year-end stocks, 30,664. Preliminary figures for January are as follows: production, 26,843; imports, 210; consumption, 25,194; exports, 1,031; and month-end stocks, 31,068.

Reclaimed Rubber Prices

	l.b.
Whole tire: first line	$0.10
Fourth line	.0875
Inner tube: black	.15
Red	.2425
Butyl	.125
Pure gum, light colored	.2425
Mechanical, light colored	.135

The above list includes those items or classes only that determine the price basis of all derivative reclaim grades. Every manufacturer produces a variety of special reclaims in each general group separately featuring characteristic properties of quality, workability, and gravity at special prices.

SCRAP RUBBER

TRADING in scrap rubber continued on the slow side during the period from February 16 to March 15. The removal of price controls on scrap had no effect on the market since quotations have been well below permitted ceilings for many months. Moderate weather during the winter resulted in a fairly good flow of scrap rubber from collectors to marketing centers, but movement to consumers has been restricted by mill buying on a limited scale to meet monthly requirements. Foreign interest in scrap rubber continued at a minimum in view of lack of dollar exchange.

Tube prices declined during the period, reflecting the almost total lack of interest by reclaimers. Tire prices were mixed, and a sharp rise in mixed auto tires took place in the East as the result of a 300-ton order. Whether the new price of $11.50-12.00 per ton for mixed tires in the East will prevail after this order is filled is a matter for conjecture.

Following are dealers' selling prices for scrap rubber, in carload lots, delivered to mills at the points indicated:

	Eastern Points	Akron, O.
	(Per Net Ton)	
Mixed auto tires	$11.50/$12.00	$14.00/$14.50
S. A. G. auto tires	Nom.	Nom.
Truck tires	Nom.	15.00
Peelings, No. 1	40.00	40.00/42.00
2	Nom.	26.00
3	20.00	20.00
	(¢ per Lb.)	
Auto tubes, mixed	2.50	2.50
Black	3.00/3.50	3.50
Red	10.00/10.50	11.00
Butyl	1.50/2.00	2.50/3.00

COTTON AND FABRICS

NEW YORK COTTON EXCHANGE
WEEK-END CLOSING PRICES

Futures	Dec. 27	Jan. 31	Feb. 21	Feb. 28	Mar. 7	Mar. 14
May	34.14	33.61	33.42	33.31	33.62	33.88
July	34.40	33.85	33.79	33.55	33.80	34.01
Oct.	34.12	33.73	33.77	33.70	33.83	33.96
Dec	34.10	33.81	33.86	33.77	33.91	34.01
Mar.	34.11	34.02	34.09	33.92	33.98	34.03
May	34.07	34.03	34.12	33.89	33.93	34.03

COTTON spot and futures prices moved irregularly upward on the New York Cotton Exchange during the period from February 16 to March 15. Trade price fixing and short covering and the absence of significant hedging pressure served to raise prices despite a moderately low level of activity. Market undertones were firm, although the distant new crop months dragged in expectation of a large new crop planting.

The spot price for 1 5/16-inch middling cotton began the period at a low of 33.55¢, rose to a high of 34.55¢ on March 12, and closed the period at 34.45¢. May futures moved similarly from a low of 33.00¢ on February 16 to a high of 33.90¢ on March 12, and closed the period at 33.88¢. The dragging tendency of the new crop months

GOOD USED MACHINERY

"Our 36th Year"

1—Farrel Birmingham 6" x 13" self-contained 3-roll Calender, m.d.
1—Farrel 6" x 12" Laboratory Washer Mill, m.d.
1—16" x 42" Rubber Mill, m.d.
4—Bolling 18" x 18", 5-opening Hydraulic Presses, 10" dia. ram.
1—6' x 24' Vulcanizer quick opening door.
1—Royle #4, 6" Extruder; 1—#1, with chrome plated screw, m.d.
4—#28 Devine Vac. Shelf Dryers, 19-59" x 78" shelves, complete.
2—Ball & Jewell #2 Rotary Cutters.
1—Patterson S S 110 gal. Vacuum Mixer, Sigma Blades.
1—B.P. 20 gal. Jacketed Mixer, Double Sigma Blades.
2—340 qt. AMF Glen Mixers, m.d.

Also other sizes Hydraulic Presses, Tubers, Banbury Mixers, Mills, Vulcanizers, Calenders, Pellet Presses, Cutters.

PHONE—WIRE—WRITE • *Send us your inquiries*

Consolidated Products Company, Inc.

13-16 Park Row, New York 38, N. Y. BArclay 7-0600

We Buy your Idle Equipment. Single items or complete plants.

Cable Address: Equipment N.Y.

HORIZONTAL MIXERS

2—1500# cap. dope mixers, glass lined, lgth. 11', dia. 5', steel constr.
2—1500# cap. dope mixers, glass lined, lgth 10' dia. 4', cast iron constr., steam jacket, 15# press.

These units are self-supporting bases, motr. driven. Prices and further information on request.

DALTON SUPPLY CO.

2829 Cedar St. Phila. 34, Pa.

Economical **NEW** Efficient

Mills - Spreaders - Churns
Mixers - Hydraulic Presses
Calenders

...GUARANTEED...

Rebuilt Machinery for Rubber and Plastics

LAWRENCE N. BARRY

41 Locust Street Medford, Mass.

RUBBER MACHINERY

Buys of the month . . . . .

MILLS

24x84"
22x60"
22x48" (Heavy Duty)
22x36" (Heavy Duty Crackers)
18x45" (See Note**)
16x40" (Several)
18x30" (Several)
16x30"
16x24"
10x24"
6x12" (Used Lab)
6x12" (New Lab)

CALENDERS

24x66" three-roll
22x60" three-roll
18x54" three-roll
18x48" three-roll
16x40" three-roll
12x30" four-roll
10x20" three-roll
8x16" three-roll
6x12" three-roll (New Lab)

HYDRAULIC PRESSES

36x36" with 30" ram
30x54" with 30" ram
24x24" with 18" ram
24x24" with 12" ram
12x12" with all size rams

WE ALSO FURNISH NEW "ARMACO" PRESSES OF THE FOLLOWING SIZES

12 x 12" 18 x 18" 24 x 24"
32 x 32" 36 x 36" 42 x 42"
48 x 48"

Also larger sizes, all presses having large diameter rams.

BANBURY MIXERS

Sizes No. B, 1, 3, 3A, 9, 11 (Complete Banbury rebuilding service available)

EXTRUDERS

1", 2", 3¼", 4½", 6", 8", 12",—All with motors and drives.

**NOTE—Due to a special purchase, we have available fifteen 18" x 45" mills which we are offering at an attractive price.

FOR THE BEST DEAL IN NEW AND USED RUBBER WORKING MACHINERY, CALL US OR STOP IN AT OUR PLANT LOCATED CLOSE TO DOWNTOWN AKRON.

AKRON RUBBER MACHINERY CO.

200 South Forge St., Akron 9, Ohio

Post Office Box 88 HEmlock 9141

RUBBER HARDNESS

THE LANGUAGE OF THE RUBBER INDUSTRY SINCE 1915

DUROMETER

VARIOUS MODELS FOR TESTING THE ENTIRE RANGE

TECHNICAL DATA ON REQUEST

THE SHORE INSTRUMENT & MFG. CO., INC.

90-35 VAN WYCK EXPRESSWAY
JAMAICA 2, N. Y.

NEW and REBUILT MACHINERY

Since 1891

L. ALBERT & SON

Trenton, N. J., Akron, Ohio, Chicago, Ill., Los Angeles, Calif.

GUARANTEED REBUILT MACHINERY

IMMEDIATE DELIVERIES FROM STOCK

MILLS, CALENDERS, TUBERS
VULCANIZERS, ACCUMULATORS

UNITED

HYD. PRESSES, PUMPS, MIXERS
CUTTING MACHINES, PULVERIZERS

UNITED RUBBER MACHINERY EXCHANGE

183-189 ORATON ST. CABLE "URME" NEWARK 4, N. J.

(Classified Advertisements Continued on Page 131)

is shown by the price for May, 1954, futures, which started the period at a differential of 0.90c over May, 1953, prices, and closed the period at a differential of only 0.15c.

Fabrics

Trading in industrial cotton fabrics slowed down during the period. Most mills are sold out into April and early May, and some are reported to have contracted for most of their output through the second quarter. Nearby deliveries were said to be non-existent in some constructions and very tight in all others. Trading was generally featureless as mills sold only moderate-size lots.

Cotton Fabrics

Drills			
59-inch 1.85-yd.	yd.	$0.39	$0.40
2.25-yd		.35	
Osnaburgs			
40-inch 2.11-yd.	yd.	.2425	.245
3.65-yd		.155	.16
Ducks			
48-inch 1.78-yd. S. F.	yd.	nom.	
2.00-yd D. F.		nom.	
51.5-inch, 1.35-yd. S. F.		nom.	
Hose and belting		.67	
Raincoat Fabrics			
Print cloth, 38½-inch, 64x60	yd.	.15	.155
Sheeting, 48-inch, 4.17-yd.		nom.	
52-inch, 3.85-yd.		nom.	
Chafer Fabrics			
14-oz. sq. yd. Pl.	lb.	.73	
11.65-oz. sq. yd. S.		.65	
10.80-oz. sq. yd. S.		.6875	
8.9-oz. sq. yd. S.		nom.	
Other Fabrics			
Headlining, 68-inch, 1.35-yd., 2-ply	yd.	nom.	
68-inch, 1.25-yd., 2-ply		.65	
Sateens, 53-inch, 1.32-yd.		.585	
58-inch, 1.21-yd.		.63175	.64
Tire Cords			
K. P. std., 12-4-2	lb.	nom.	

RAYON

SHIPMENTS of all types of rayon by domestic producers totaled 102,100,000 pounds in January and 93,000,000 pounds in February. Of this total, domestic shipments accounted for 100,800,000 pounds in January and 91,600,000 pounds in February. Calculated production of all types of rayon was 103,700,000 pounds in January and 90,100,000 pounds in February, or 79% and 74% of rated capacity, respectively. Rayon stocks at the end of February amounted to 80,400,000 pounds.

Calculated production of viscose high-tenacity yarn during January and February was 38,700,000 and 36,400,000 pounds, respectively. Production was at 98% of capacity in January and 100% in February. Total shipments, both domestic and export, of high-tenacity yarn amounted to 38,200,000 pounds in January and 36,000,000 pounds in February. Of these totals, exports accounted for 300,000 and 100,000 pounds respectively. Stocks of high-tenacity yarn at the end of February were 6,200,000 pounds.

No changes were made in rayon tire cord and fabric prices during the period from February 16 to March 15, and current prices follow:

Rayon Prices

Tire Yarns		
1100/480		$0.63
1100/490		.62
1150/490		.62
1650/720		.62
1650/980		.61
1900/980		.61
2200/960		.61
2200/980		.60
4400/2934		.63
Tire Fabrics		
1100/490/2		.72
1650/980/2	$0.659	.73
2200/980/2		.685

Carbon Black Statistics—Fourth Quarter and Year, 1952

Below are statistics for output, shipments, producers, stocks, and exports of carbon black for the fourth quarter and year, 1952. Furnace blacks are classified as follows: SRF, semi-reinforcing furnace black; HMF, high modulus furnace black; FEF, fast extruding furnace black; and HAF, high abrasion furnace black. Statistics on thermal black are included with SRF black to avoid disclosure of individual company operations.

(Thousands of Pounds)

	Oct.	Nov.	Dec.	Year 1952
Production:				
Furnace types:				
SRF	27,327	26,287	29,846	347,639
HMF	9,121	9,112	9,156	127,623
FEF	15,070	15,735	17,965	194,496
HAF	33,009	35,511	38,542	370,730
Total furnace	84,527	86,645	95,509	1,040,498
Contact types	44,158	41,272	42,931	564,098
TOTALS	128,685	127,917	138,440	1,604,596
Shipments:				
Furnace types:				
SRF	32,078	29,512	30,060	333,280
HMF	10,012	9,815	10,372	109,230
FEF	18,624	15,402	19,253	191,865
HAF	33,484	34,366	37,582	367,190
Total furnace	94,198	89,095	97,267	1,001,565
Contact types	39,194	36,953	35,791	451,874
TOTALS	133,392	126,048	133,058	1,453,439
Producers' Stocks, End of Period:				
Furnace types:				
SRF	37,736	34,511	34,297	34,297
HMF	36,026	35,323	34,107	34,107
FEF	22,632	22,965	21,677	21,677
HAF	28,329	29,474	30,434	30,434
Total furnace	124,723	122,273	120,515	120,515
Contact types	222,868	227,187	234,327	234,327
TOTALS	347,591	349,460	354,842	354,842
Exports:				
Furnace types	12,413	10,482	13,819	125,530
Contact types	11,046	12,024	10,158	167,377
TOTALS	23,459	22,506	23,977	292,907

SOURCE: Bureau of Mines, United States Department of the Interior, Washington, D. C.

Estimated Automotive Pneumatic Casings and Tubes Shipments, Production, Inventory, January, 1953, December, January, 1952

	January, 1953	% of Change from Preceding Month	December, 1952	January, 1952
Passenger Casings				
Shipments				
Original equipment	2,563,419		2,446,008	1,659,754
Replacement	3,915,914		2,447,462	3,392,875
Export	33,000		82,567	56,791
TOTAL	6,512,423	−30.88	4,976,037	5,109,420
Production	6,824,097	−4.67	6,519,572	6,265,423
Inventory end of month	11,287,880	−0.40	11,242,481	8,069,652
Truck and Bus Casings				
Shipments				
Original equipment	440,465		470,231	480,245
Replacement	877,945		725,243	849,971
Export	50,858		54,819	89,355
TOTAL	1,369,268	−9.52	1,250,293	1,419,571
Production	1,413,890	−0.81	1,425,419	1,606,269
Inventory end of month	2,829,636	−0.83	2,853,260	1,969,115
Total Automotive Casings				
Shipments				
Original equipment	3,003,884		2,916,239	2,139,999
Replacement	4,793,859		3,172,705	4,242,846
Export	83,948		137,386	146,146
TOTAL	7,881,691	−26.59	6,226,330	6,528,991
Production	8,237,987	−3.69	7,944,991	7,871,692
Inventory end of month	14,117,516	+0.15	14,095,741	10,038,767
Passenger, Including Motorcycle and Truck and Bus Tubes				
Shipments				
Original equipment	3,012,081		2,910,428	2,143,822
Replacement	4,453,560		1,900,773	3,231,808
Export	49,089		57,344	99,257
TOTAL	7,514,730	+54.35	4,868,545	5,474,887
Production	6,130,234	−8.62	5,643,807	5,581,856
Inventory end of month	10,169,168	−13.41	11,743,881	10,342,795

NOTE: Data on this report include adjustments made in prior months.
SOURCE: The Rubber Manufacturers Association, Inc., New York, N. Y.

Compounding Ingredients—Price Changes and Additions

Accelerator-Activators, Inorganic

Litharge, Eagle	lb.	$0.1625	$0.1635
National Lead	lb.	.1575	.1585
Red lead, Eagle	lb.	.1725	
National Lead	lb.	.1675	.17

Accelerator-Activators, Organic

Emersol 110	lb.	.11	.1225
120	lb.	.115	.1275
130	lb.	.1375	.15
210 Elaine	lb.	.1075	.1375
Emery 600	lb.	.1075	.1375

Antioxidants

Akroflex CD	lb.	.695	.715

Carbon Blacks

(CC) Spheron I	lb.	.12	.165
N	lb.	.25	.29
(CF) Vulcan C	lb.	.11	.153
(HAF) Vulcan 6	lb.	.11	.153
(SAF) Vulcan 9	lb.	.135	.178
(SRF) Pelletex NS	lb.	.04	.08
Sterling R	lb.	.045	.085
(MT) Sterling MT	lb.	.035	.045

Chemical Stabilizers

Agus stabilizers	lb.	.60	1.38
Staycin 1	lb.	.65	

(Continued on page 132)

MACHINERY AND SUPPLIES FOR SALE (Continued)

REBUILT BANBURY BODIES AND PARTS FOR SALE OR INterchange. Sizes #9 and #11 complete bodies available. Extra parts include rotors, door tops, and rings. We rebuild all sizes of Banburys and can also fabricate any parts needed. Our "Pre-Plan" rebuilding method saves your production time. Write for prices and details. INTERSTATE WELDING SERVICE, Offices, Metropolitan Bldg., Akron 8, Ohio.

MACHINERY AND SUPPLIES WANTED

WANTED: RUBBER MACHINERY INCLUDING BANBURY Mixers, Heavy-Duty Mixers, Calenders, Rubber Rolls & Mixers, Extruders, Grinders & Cutters, Hydraulic Equipment, Rotary and Vacuum Shelf Dryers, Injection Molding Machines. Will consider a now operating or shut down plant. P. O. Box 1351, Church Street Sta., New York 8, N. Y.

WANTED: RUBBER MILLS, CALENDERS, MIXERS, BANbury Mixers, Extruders, Grinders, Cutters, Hydraulic Presses, Injection Molding Machines. CONSOLIDATED PRODUCTS CO., INC., 13-16 Park Row, New York 38, N. Y. BArclay 7-0600.

WANTED: TWO #4 LATE MODEL THROPP RUBBER WASHER cutters. Address Box No. 1285, care of India Rubber World.

WANTED: USED TWO-ROLL RUBBER MIXING MILL 22" X 60" complete with motor, drive, brake, and controls. Address Box No. 1286, care of India Rubber World.

ONE 16" X 48" RUBBER MIXING MILL, MOTOR DRIVEN, MUST be in good operating condition. In reply give make, age, price, and location. Address Box No. 1292, care of India Rubber World.

BUSINESS OPPORTUNITIES

WANTED: GOING CONCERN MANUFACTURING RUBBER COATED FABRICS LOCATED east of Mississippi and equipped completely or partly with spreaders, churns, curing and wrapping equipment. Would also consider press molding equipment, calenders, and mills. Prefer company selling up to $1,000,000 per annum. Address Box No. 1282, care of India Rubber World.

COMPLETELY EQUIPPED RUBBER MANUFACTURING PLANT for sale, located in South, modern equipment for manufacturing molded rubber products, excellent labor market, new building, 20,000 sq. ft., 4 acres ground. Address Box No. 1283, care of India Rubber World.

COMPLETELY EQUIPPED DIPPED RUBBER GOODS PLANT operating profitably, manufacturing gloves and baby pants, able to make all dipped-type products, completely equipped, operating two shifts, excellent labor market; can be seen in operation. Address Box No. 1284, care of India Rubber World.

WANTED to BUY

A client of ours is interested in purchasing for cash all or two-thirds of a well-established company manufacturing mechanical rubber goods. Our client is now in this field and wishes to expand by purchasing another company with annual sales of $3,000,000.00 to $5,000,000.00. Management may stay. Preferred location middle west.

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Industrial Financing

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Surplus capacity available to customers' specifications on No. 3A Banbury Type Machine. We are manufacturers of Molded, Lathe Cut, and Extruded Soft Rubber Goods and have surplus mixing capacity.

MARTIN RUBBER COMPANY
Long Branch Ave., Long Branch, N. J.
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Precision Workmanship

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AS YOU WANT IT. QUICK SERVICE
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FOR SALE

1—Banbury #1 Mixer with 50 HP Motor.
1—Stewart Bolling 2-roll Lab. Mill 6" x 12".
1—Thropp 2-roll Rubber Mill 10"x24".
2—Thropp 2-roll Rubber Mills, 18"x30".
1—Thropp 2-roll Rubber Mill 14" x 30".
1—Adamson Vulcanizer, 2' x 4' & 2' x 12' with quick opening door.
1—Ball & Jewell Stainless Steel #0 Rotary Cutter with Motor.
1—Paul O. Abbe #2 Master Rotary Cutter with Ball Bearings.
1—Welding Engr. Stainless Steel #2 Extruder.
1—Sprout Waldron Attrition Mill, Type 36 with 2 — 75 HP Motors.

WE ARE INTERESTED IN PURCHASING ALL TYPES OF RUBBER machinery consisting of mills, Banbury mixers, extruders, calenders, vulcanizers etc. and also complete plants.

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STATE HIGHWAY No.29, UNION, N.J.
UNIONVILLE-2-4900

MANUFACTURING BUSINESS WANTED

We are now manufacturing over $20,000,000 in various lines and wish to expand by acquisition of assets or stock of one or more industrial companies. In our negotiations the sellers' problems and wishes will receive full consideration. Present personnel will normally be retained. Address all replies "confidentially" C. J. GALE, Sec., 233 Broadway, New York 7, N. Y. BArclay 7-1819.

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We do milling and compounding of all types — blacks or colors — Master Batches —
All mixing done under careful supervision and laboratory control.

PEQUANOC RUBBER CO.
Phone: Butler 9-0400 BUTLER, NEW JERSEY

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An Industry-Wide Project for the Development of an Automatic Packaging Device for Pelleted Carbon Black and the Development of the Most Efficient Container for Such Black.

THIS IS AN INVITATION to any individual, company or corporation engaged in the manufacture of carbon black to participate as a stockholder in the new non-profit group, Carbon Black Packaging, Inc., recently organized for the purpose of developing an effective automatic packaging device for pelleted carbon black and the development of the most efficient and most economical container for such black.

CHARTERED in the State of Delaware, December 23, 1952.

FINANCING of the development program will be accomplished from a fund contributed by the stockholders and available for expenditure during the five year term of the agreement. In no event shall the stockholder's contribution be less than $1,000 per year or more than $20,000 per year.

SHARES in Carbon Black Packaging, Inc., are now offered for sale to individuals, companies or corporations. All contributions made to Carbon Black Packaging, Inc., including any income, will be used to meet expenses of the program. The stock in Carbon Black Packaging, Inc., is non-dividend bearing and will not in any case return to the owner more than the amount of cash contributed by them or it.

DEVICES or techniques developed as a result of the program may be used by stockholder without further payment.

PERSONNEL required to carry on the research program will be obtained through the employment of a competent director of research with a carefully selected staff or existing research institutes utilizing manufacturing plants and existing laboratory facilities to minimize or eliminate investment of the research funds in capital items.

Address Inquiries to: Carbon Black Packaging, Inc.
Box 1389
Bartlesville, Oklahoma

U. S. Imports, Exports and Reexports of Crude and Manufactured Rubber

Imports for Consumption of Crude and Manufactured Rubber

	November, 1952	
	Quantity	Value
UNMANUFACTURED, LBS.		
Crude rubber	99,580,946	$24,209,723
Latex	9,678,186	2,866,961
Balata	395,352	139,154
Jelutong or Pontianak	175,740	67,764
Gutta percha	40,513	23,392
Crude chicle	842,257	675,271
Synthetic rubber	4,612,854	1,172,231
Reclaimed rubber	860,124	53,599
Scrap rubber	1,826,451	88,379
TOTALS	118,012,423	$29,296,474
MANUFACTURED		
Rubber tires		
Auto, etc. *no.*	2,646	$138,404
Bicycles *no.*	4,572	3,418
Other *no.*	148	13,998
Inner tubes: auto, etc. *no.*	388	830
Footwear		
Boots *prs.*	22,118	52,573
Shoes and overshoes *prs.*	35,334	26,852
Rubber-soled canvas shoes *prs.*	3,979	2,495
Athletic balls		
Golf *no.*	14,640	4,871
Other *no.*	70,080	7,565
Hard rubber goods		
Combs *no.*	42,060	3,842
Drug sundries	.....	463
Other	.....	1,529
Rubber toys	.....	28,911
Rubberized printing blankets *lbs.*	2,035	5,133
Rubber and cotton packing *lbs.*	2,033	4,016
Gaskets and valve packing	.....	7,947
Molded insulators	.....	5,099
Belting *lbs.*	10,850	13,702
Hose and tubing	.....	6,622
Gloves *prs.*	79,924	18,352
Nipples and pacifiers *gr.*	1,900	2,638
Instruments	785	4,118
Heels and soles *lbs.*	1,050	303
Bands *lbs.*	2,432	676
Other	.....	1
Gutta percha manufacturers *lbs.*	19,220	10,063
Synthetic rubber products	.....	19,967
Other soft rubber goods	.....	85,007
TOTALS	.....	$463,561
GRAND TOTALS, IMPORTS	.....	$29,760,035

Reexports of Foreign Merchandise

UNMANUFACTURED, LBS.		
Crude rubber	1,310,039	$414,704
Balata, gutta percha, etc.	16,653	17,169
Chicle and chewing gum bases	49,239	36,919
TOTALS	1,375,931	$468,792
MANUFACTURED		
Rubber drug sundries	.....	$225
Toys, balls, novelties	.....	813
TOTALS	.....	$1,038
GRAND TOTALS, REEXPORTS	.....	$469,830

Exports of Domestic Merchandise

	November, 1952	
	Quantity	Value
UNMANUFACTURED, LBS.		
Chicle and chewing gum bases	408,064	$200,262
Balata, gutta percha, etc.	750	1,905
Synthetic rubbers		
GR-S type	493,354	142,946
Butyl	100,800	21,924
Neoprene	1,547,333	635,034
Nitrile types	298,694	161,175
Other	131,207	86,250
Reclaimed rubber	2,351,641	210,983
Scrap rubber	2,694,454	68,028
TOTALS	8,026,297	$1,528,507
MANUFACTURED		
Rubber cement *gals.*	61,971	$128,774
And rubberized fabric *sq. yds.*	117,298	97,233
Clothing	.....	138,234
Footwear		
Boots and shoes *prs.*	15,408	42,496
Rubber-soled canvas shoes *prs.*	16,630	21,906
Heels *doz. prs.*	38,530	51,106
Soles, soling, toplift sheets *lbs.*	785,311	195,935
Gloves and mittens *doz. prs.*	9,310	38,459
Drug sundries	.....	195,839
Toys, balls, novelties	.....	89,405
Hard rubber goods		
Battery boxes *no.*	18,569	26,135
Other electrical *lbs.*	146,121	80,825
Other	.....	27,309
Rubber tires and castings		
Truck and bus *no.*	48,545	2,495,503
Auto and motorcycle *no.*	36,201	457,952
Aircraft *no.*	975	68,306
Off-the-road *no.*	10,496	1,376,950
Farm tractor *no.*	5,052	205,583
Implement *no.*	1,995	34,560
Other *no.*	10,371	30,800
Inner tubes		
Auto *no.*	13,838	25,760
Truck and bus *no.*	46,626	372,468
Aircraft *no.*	512	4,365
Other *no.*	15,553	57,079
Solid tires: truck and industrial *no.*	5,753	26,948
Tire repair material		
Camelback *lbs.*	776,700	234,335
Other *lbs.*	343,761	291,813
Tape, except medical and friction *lbs.*	53,660	36,458
Belting		
V-type auto *lbs.*	57,272	81,235
Transmission V-type *lbs.*	88,038	190,464
Flat belts *lbs.*	32,687	56,288
Conveyors and elevator *lbs.*	178,313	170,625
Other *lbs.*	6,700	15,146
Hose		
Molded and braided *lbs.*	286,875	260,906
Wrapped and hand built *lbs.*	129,520	137,793
Other hose and tubing *lbs.*	92,559	105,746
Thread: bare *lbs.*	12,212	24,248
Textile covered *lbs.*	14,480	40,882
Rubber packing		
Sheet type *lbs.*	32,471	$20,638
Other *lbs.*	147,350	196,420
Tiling and flooring *lbs.*	40,457	12,395
Mats and matting *lbs.*	441,637	128,852
Compounded rubber for further manufacture *lbs.*	1,352,659	373,171
Other rubber manufactures *lbs.*	.....	508,069
TOTALS	.....	$9,175,414
GRAND TOTALS, ALL RUBBER EXPORTS	.....	$10,703,921

SOURCE: Bureau of the Census, United States Department of Commerce, Washington, D. C.

Compounding Ingredients

(Continued from page 130)

Plasticizers and Softeners

Cabflex DCP *lb.*	.35	/	.3775
DDA *lb.*	.46	/	.4875
DDP *lb.*	.38	/	.4075
Di-BA *lb.*	.3925	/	.42
OA *lb.*	.43	/	.4575
OP *lb.*	.37	/	.3975
PT 67 Light Pine Oil *gal.*	.60		
101 Pine Tar Oil *gal.*	.3485	/	.455
400 Light Pine Tar *gal.*	.361	/	.47
600 Medium Pine Tar *gal.*	.365	/	.475
800 Heavy Pine Tar *gal.*	.369	/	.48

Solvents

PT 150 Pine Solvents *gal.*	.44	

Vulcanizing Agents

Litharge, Eagle *lb.*	.1625	/	.1635
National Lead *lb.*	.1575	/	.1585
Red lead, Eagle *lb.*	.1725		
National Lead *lb.*	.1675	/	.17

Trade Lists Available

The Commercial Intelligence Division recently published the following trade lists, of which mimeographed copies may be obtained by firms domiciled in the United States from this Division and from Department of Commerce Field Offices. The price is $1 a list for each country.

Automobile Vehicle & Equipment Importers & Dealers: Lebanon; Philippines; Thailand.

Boot & Shoe Importers & Dealers: Morocco.

Electrical Supply & Equipment Importers & Dealers: Dominican Republic; Iraq; Tunisia.

Plastic Material Manufacturers, Molders, Laminators & Fabricators of Plastic Products: India.

Tire Retreaders, Recappers & Repairers: Turkey.

United States Rubber Statistics — December and Year, 1952

(All Figures in Long Tons, Dry Weight)

	December						Yearly Totals					
	New Supply			Distribution		Month-End Stocks	New Supply			Distribution		Year-End Stocks
	Production	Imports	Total	Consumption	Exports		Production	Imports	Total	Consumption	Exports	
Natural rubber, total	0	72,115	72,115	39,297	615	89,059	0	757,269	757,769	400,279	3,024	89,059
Latex, total	0	6,033	6,033	5,493	0	6,201	0	48,228	48,228	53,567	0	6,201
Rubber and latex, total	0	78,148	78,148	44,790	615	95,260	0	805,997	805,997	453,846	3,024	95,260
Synthetic rubbers, total	*$57,837 †7,903	1,523	67,263	71,635	1,317	118,987	*$715,337 †82,229	19,891	818,457	807,037	22,101	118,987
GR-S types‡	*$52,323 †0	1,282	53,605	58,442	267	83,861	*$636,969 †256	17,629	654,854	666,420	9,467	83,861
Butyl	*5,514	214	5,755	6,524	0	22,716	†79,368	2,262	81,630	71,229	126	22,716
Neoprene‡	†6,429	0	6,429	5,356	864	8,535	†65,745	0	65,745	55,522	9,813	8,535
Nitrile types‡	†1,474	0	1,474	1,313	186	3,875	†16,228	0	16,228	13,866	2,695	3,875
Natural rubber and latex, and synthetic rubbers, total	65,740	79,671	145,411	116,425	1,932	214,247	797,566	825,888	1,623,454	1,260,883	25,125	214,247
Reclaimed rubber, total	25,606	36	25,642	24,300	1,012	30,664	278,386	1,595	279,981	280,002	11,180	30,664
GRAND TOTALS	91,346	79,707	171,053	140,725	2,944	244,911	1,075,952	827,483	1,903,435	1,540,885	36,305	244,911

*Government plant production.
†Private plant production.
‡Includes latices.
SOURCE: Rubber Division, NPA, United States Department of Commerce, Washington, D. C.

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